

RFP 2427-KY

**Mesa County
Justice Center 2nd
Floor Renovation**

**125 N. Spruce Street
Grand Junction, CO
81501**

PROJECT MANUAL

Architects Project No. 23040

For Construction

08/30/2024



**Architecture
Interior Design
Project Management**

**622 Rood Avenue
Grand Junction, CO 81501
970-242-1058 office**

BLYTHE GROUP + co.

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END OF SECTION

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SECTION 004322 UNIT PRICES FORM

PARTICULARS

1.01 THE FOLLOWING IS THE LIST OF UNIT PRICES REFERENCED IN THE BID SUBMITTED BY:

1.02 (BIDDER) _____

1.03 DATED _____ AND WHICH IS AN INTEGRAL PART OF THE BID FORM.

1.04 THE FOLLOWING ARE UNIT PRICES FOR SPECIFIC PORTIONS OF THE WORK AS LISTED, AND ARE APPLICABLE TO AUTHORIZED VARIATIONS FROM THE CONTRACT DOCUMENTS.

UNIT PRICE LIST

2.01 ITEM 1:

- A. Description: Remedial Floor Coating of concrete slab per requirements of Section 09 05 61 - Common Work Results for Flooring Preparation.
- B. Unit of Measure: Square foot as applied per manufacturer's requirements.
- C. Cost per Unit: _____

2.02 ITEM 2:

- A. Description: Alternatate Flooring Adhesive per requirements of Section 09 05 61 - Common Work Results for Flooring Preparation.
- B. Unit of Measure: Square foot as applied per manufacturer's requirements.
- C. Cost per Unit: _____

2.03 ITEM 3:

- A. Description: Spray Applied Fireproofing per requirements of Section 07 81 00 Applied Fire Protection.
- B. Unit of Measure: Square foot at thickness per manufacturer's requirements.
- C. Cost per Unit: _____

END OF SECTION

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SECTION 004323 ALTERNATES FORM

PARTICULARS

1.01 THE FOLLOWING IS THE LIST OF ALTERNATES REFERENCED IN THE BID SUBMITTED BY:

1.02 (BIDDER) _____

1.03 DATED _____ AND WHICH IS AN INTEGRAL PART OF THE BID FORM.

ALTERNATES LIST

2.01 THE FOLLOWING AMOUNTS SHALL BE ADDED TO OR DEDUCTED FROM THE BID AMOUNT. REFER TO SECTION 012300 - ALTERNATES.

ALTERNATE # 1 (PLATFORM LIFT): ADD / (DEDUCT) \$ _____

ALTERNATE # 2 (OPERABLE PARTITION): ADD / (DEDUCT) \$ _____

ALTERNATE # 3 (ALTERNATE FINISHES): ADD / (DEDUCT) \$ _____

ALTERNATE # 4 (PARKING LOT MODS): ADD / (DEDUCT) \$ _____

ALTERNATE # 5 (SALVAGED DOORS / HARDWARE): ADD / (DEDUCT) \$ _____

ALTERNATE # 6 (WINDOW SHADES): ADD / (DEDUCT) \$ _____

END OF SECTION

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SECTION 011000 SUMMARY

PART 1 GENERAL

1.01 PROJECT

- A. Project Name: 23040 Mesa County Justice Center 2nd Floor Renovation
- B. Architect's Name: Blythe Group + co.
- C. The Project consists of the alteration of the second floor of the existing building at 125 N. Spruce Street, Grand Junction, CO 81501.

1.02 DESCRIPTION OF ALTERATIONS WORK

- A. Scope of demolition and removal work is indicated on drawings and specified in Section 024100.
- B. Scope of alterations work is indicated on drawings.

1.03 WORK BY OWNER

- A. Items noted FBO (Furnished By Owner) will be supplied and installed by Owner before Date of Substantial Completion. Some items include:
 - 1. Furnishings.
 - 2. Small equipment.

1.04 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.

1.05 CONTRACTOR USE OF SITE AND PREMISES

- A. Arrange use of site and premises to allow:
 - 1. Owner occupancy.
 - 2. Use of site and premises by the public.
- B. Provide access to and from site as required by law and by Owner:
 - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 - 2. Do not obstruct roadways, sidewalks, or other public ways without permit.
- C. Existing building spaces may not be used for storage.
- D. Time Restrictions:
 - 1. Limit conduct of all work to nights (defined as the hours of 5:00 PM to 8:00 AM, Monday through Friday) and weekends (Saturday and Sunday) and Mesa County holidays. There will be occasional exceptions to these periods - coordinate with Owner.
- 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.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 011001 ELECTRONIC DRAWING RELEASE FORM

PROJECT: MESA COUNTY JUSTICE CENTER 2ND FLOOR RENOVATION

PROJECT NUMBER: 23040

TO:

FROM:

BLYTHE GROUP + CO. _____

622 ROOD AVENUE _____

GRAND JUNCTION, CO 81501 _____

ATTENTION:

CONTRACTOR HEREBY REQUESTS ARCHITECT'S ELECTRONIC DRAWING FILES FOR USE IN CONNECTION WITH THE PROJECT IN ACCORDANCE WITH PROVISIONS OF THE CONTRACT DOCUMENTS.

THERE IS THE POTENTIAL FOR LIABILITY PROBLEMS WHEN RELEASING ELECTRONIC DRAWING FILES. CONSEQUENTLY, THE ITEMS LISTED BELOW MUST BE AGREED TO PRIOR TO RELEASING THE FILES.

- A. You agree to hold harmless, indemnify in full, BG+co (Blythe Group + co.), their consultants, agents, employees, servants, and assigns, from and against any and all liability, claims and demands arising out of the use of electronic files provided. This indemnification and hold harmless agreement includes, but is not limited to, any claims, directly or indirectly, for damages, demands or other actions including personal injuries, brought by any persons who seek recovery from BG+co (Blythe Group + co.), their consultants, agents, employees, servants and assigns, regarding the use of the electronic files. It is specifically understood and agreed upon by you, that the content of the electronic files provided has been accomplished with input from the Owner. BG+co (Blythe Group + co.), their consultants, agents, employees, servants and assigns, assume no responsibility for any unauthorized changes or alterations to, nor the accuracy of, the electronic files provided.
- B. The electronic files are provided solely as a convenience and benefit of the Owner for whom design services have been performed and shall NOT be considered "Contract Documents", "Construction Documents" or any type of certified document.
- C. The hard copy bid documents, accompanied by a professional's stamp and signature, are the project documents of record and govern over any electronic files.
- D. Further, contractor acknowledges that electronic model files have been prepared for architect's work and not for contractor's use for shop drawings, clash detection, coordination of subcontractor's work or any other means and method, etc., work by the contractor.
- E. The electronic files are Copyrighted material, are to be used only for this project and are to be used only by you and shall be shared only with subcontractors as pertinent to this project. Any and all use of these files for purposes other than directly related to this project is expressly prohibited.
- F. All individual components used to create the model are the sole property of Blythe Group + co. and may not be extracted, exported or otherwise removed from the model file provided.
- G. This electronic information provides design intent information current as of the date of its release. Any use of this information is at the sole risk and liability of the user who is responsible for performing all checking, review and coordination as necessary to ensure the data obtained from the electronic file is accurate, the same data as shown on the record hard copy documents, and for updating any information required to reflect any changes in the design not included in this electronic file to accommodate work performed by use of this electronic file(s).

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RELEASE FORM**

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- H. The accuracy of electronic files which have been translated to a different format, whether by others or by the Architect, shall not be guaranteed by Architect or engineer. Conversion of this electronic information from the system and format used by the Architect or Architect's consultants cannot be accomplished without the introduction of inexactitudes, anomalies, omissions and errors. In the event the electronic data furnished is converted, user agrees to assume all risks associated with such conversion.
- I. In the event BG+co (Blythe Group + co.) determines there is extended cost to provide electronic data beyond their contract, Blythe reserves the right to charge the Contractor for copies of electronic media without waiving any of its requirements, conditions or rights to the electronic models or their use.
- J. The files are being requested in
____ AUTOCAD version ____ 2018 ____ 2013 ____ 2010 ____ 2007.

Drawing sheets requested:

____ Revit Version ____ 2021 ____ 2020 ____ 2019.

BIM model being requested:

I AGREE TO THE TERMS OF THIS LETTER.

Name: _____

Title: _____

Date: _____

Comments:

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SECTION 012000 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.

1.02 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. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section.
- D. Include in each line item, the amount of Allowances specified in this section. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by the unit cost to achieve the total for the item.
- E. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.
- F. Revise schedule to list approved Change Orders, with each Application For Payment.

1.03 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: Submit at intervals stipulated in the Agreement.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- C. Forms filled out by hand will not be accepted.
- D. Execute certification by signature of authorized officer.
- E. 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.
- F. Submit one electronic and three hard-copies of each Application for Payment.
- G. Include the following with the application:
 - 1. Transmittal letter as specified for submittals in Section 013000.
 - 2. Construction progress schedule, revised and current as specified in Section 013000.
 - 3. Partial release of liens from major subcontractors and vendors.
 - 4. Affidavits attesting to off-site stored products.

1.04 MODIFICATION PROCEDURES

- A. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.
- B. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
 - 1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
 - 2. Promptly execute the change.
- C. 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 with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 10 days.
- D. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
- E. Substantiation of Costs: Provide full information required for evaluation.

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1. Provide the following data:
 - a. Quantities of products, labor, and equipment.
 - b. Taxes, insurance, and bonds.
 - c. Overhead and profit.
 - d. Justification for any change in Contract Time.
 - e. Credit for deletions from Contract, similarly documented.
- F. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- G. 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.
- H. 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.
- I. Promptly enter changes in Project Record Documents.

1.05 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 017000.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 012200 UNIT PRICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. List of unit prices required to be included in the bids.
- B. Measurement and payment criteria applicable to Work performed under a unit price payment method.

1.02 RELATED REQUIREMENTS

- A. Document 004322 - Unit Prices Form: List of Unit Prices as supplement to Bid Form
- B. Section 012000 - Price and Payment Procedures: Additional payment and modification procedures.

1.03 COSTS INCLUDED

- A. Unit Prices included on the Bid Form shall include full compensation for all required labor, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.

1.04 UNIT QUANTITIES SPECIFIED

- A. Quantities indicated in the Unit Price Form are for bidding and contract purposes only. Quantities and measurements of actual Work will determine the payment amount.

1.05 MEASUREMENT OF QUANTITIES

- A. Measurement methods delineated in the individual specification sections complement the criteria of this section. In the event of conflict, the requirements of the individual specification section govern.
- B. Take all measurements and compute quantities. Measurements and quantities will be verified by Owner.
- C. Assist by providing necessary equipment, workers, and survey personnel as required.
- D. Measurement by Area: Measured by square dimension using mean length and width or radius.
- E. Linear Measurement: Measured by linear dimension, at the item centerline or mean chord.
- F. Stipulated Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as a completed item or unit of the Work.

1.06 PAYMENT

- A. Payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities of Work that is incorporated in or made necessary by the Work and accepted by the Architect, multiplied by the unit price.
- B. Unit prices are intended to be used for additions to or deletions from the quantities indicated in the Contract Documents and already included in the GMP.
- C. Payment will not be made for any of the following:
 - 1. Products wasted or disposed of in a manner that is not acceptable.
 - 2. Products determined as unacceptable before or after placement.
 - 3. Products not completely unloaded from the transporting vehicle.
 - 4. Products placed beyond the lines and levels of the required Work.
 - 5. Products remaining on hand after completion of the Work.
 - 6. Loading, hauling, and disposing of rejected Products.
- D. **Changes to contract amount based on unit prices are only permitted with prior approval of Owner.**

1.07 SCHEDULE OF UNIT PRICES

- A. Item 1: Remedial Floor Coating; Section 09 05 61 - Common Work Results for Flooring Preparation.
- B. Item 2: Alternate Flooring Adhesive; Section 09 05 61 - Common Work Results for Flooring Preparation.
- C. Item 3: Spray Applied Fireproofing; Section 07 81 00 Applied Fire Protection.

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PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

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SECTION 012300 ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Description of Alternates.

1.02 RELATED REQUIREMENTS

- A. Document 004323 - Alternates Form: List of Alternates as supplement to Bid Form.

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.

1.04 SCHEDULE OF ALTERNATES

- A. Alternate No. 1 - Platform Lift:
 - 1. Base Bid Item: Section 096900 and Drawing number A1-1 including two sets of stairs to access Judge's Bench..
 - 2. Alternate Item: Section 144200 and Drawing number A4-1 / Detail 3 including Provide platform lift in lieu of one set of stairs to access the Judge's Banch.
- B. Alternate No. 2 - Operable Partition:
 - 1. Base Bid Item: Section N/A and Drawing number A1-1 including no operable partition in meeting room 2024 .
 - 2. Alternate Item: Section 102239 and Drawing number A1-1 including provide operable partition in meeting room 2024.
- C. Alternate No. 3 - Alternate Finish Schemes:
 - 1. Base Bid Item: Section Multiple and Drawing number A7-1 including base bid finish scheme..
 - 2. Alternate Item: Section Multiple and Drawing number A7-1 / ROOM FINISH LEGEND including alternate finish scheme - IWP changes to oak wall paneling (section 064200) and ST-1 changes to natural stone (Section 097500).
- D. Alternate No. 4 - Exterior Parking Lot Modifications:
 - 1. Base Bid Item: Section N/A and Drawing number N/A including exterior parking lot to remain as is.
 - 2. Alternate Item: Section N/A and Drawing number AS1-1 and Civil drawings including exterior parking lot modifications as shown in drawings.
- E. Alternate No. 5 - Reinstall Salvaged Doors and Hardware:
 - 1. Base Bid Item: Section Multiple and Drawing number G0-1, AD1-1, A1-1 and A5-1 including provide new doors and door hardware at doors indicated on sheet G0-1.
 - 2. Alternate Item: Section Multiple and Drawing number G0-1, AD1-1, A1-1, and A5-1 including reinstallation of salvaged doors and hardware at doors listed ion sheet G0-1.
- F. Alternate No. 6 - Window Shades in Courtroom:
 - 1. Base Bid Item: Section 122113 and Drawing number A1-1 including no new window shades at existing exterior windows in new courtroom.
 - 2. Alternate Item: Section 122123 and Drawing number A1-1 including new window shades at existing exterior windows in new courtroom.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 012500 SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

- A. Section 01 25 01-Substitution Request Form.
- B. Section 013000 - Administrative Requirements: Submittal procedures, coordination.
- C. Section 016000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

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 coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
 - 4. Waives claims for additional costs or time extension that may subsequently become apparent.
 - 5. Agrees to reimburse Owner 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.
 - 1. Note explicitly any non-compliant characteristics.
- C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
 - 1. Forms indicated 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. Submittal Time Restrictions:
 - 1. Instructions to Bidders specifies time restrictions and the documents required for submitting substitution requests during the bidding period; Mesa County to determine substitution deadline.
- B. Submittal Form (before award of contract):
 - 1. Submit substitution requests by completing the form attached to this section. See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

- A. Submittal Form (after award of contract):
 - 1. Submit substitution requests by completing the form attached to this section. See this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.
- B. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.

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- C. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
 - 1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways. Substitutions that do not benefit the Owner will not be considered.
 - 2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
 - 3. Bear the costs engendered by proposed substitution of:
 - a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request.

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.
 - 1. Architect's decision following review of proposed substitution will be noted on the submitted form.

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.

3.06 CLOSEOUT ACTIVITIES

- A. See Section 017800 - Closeout Submittals, for closeout submittals.
- B. Include completed Substitution Request Forms as part of the Project record. Include both approved and rejected Requests.

3.07 ATTACHMENTS

- A. A facsimile of the Substitution Request Form required to be used on the Project is included after this section.

END OF SECTION

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SECTION 012501 SUBSTITUTION REQUEST FORM

PROJECT: MESA COUNTY JUSTICE CENTER 2ND FLOOR RENOVATION

PROJECT NUMBER: 23040

TO

FROM: (CONTRACTOR)

BG+CO

622 ROOD AVENUE

GRAND JUNCTION, CO 81501

CONTRACTOR AND SUPPLIER HEREBY REQUEST ACCEPTANCE OF THE FOLLOWING PRODUCT OR SYSTEMS AS A SUBSTITUTION IN ACCORD WITH PROVISIONS OF THE CONTRACT DOCUMENTS.

SPECIFIED PRODUCT OR SYSTEM:

SUBSTITUTION REQUEST FOR:

SPECIFICATION SECTION NO.

ARTICLE(S)

PARAGRAPH(S)

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SUPPORTING DATA:

PRODUCT DATA FOR PROPOSED SUBSTITUTION IN ACCORD WITH CONTRACT REQUIREMENTS.

SAMPLE IS ATTACHED _____ SAMPLE WILL BE SENT IF REQUESTED _____

QUALITY COMPARISON:

SPECIFIED PRODUCT	PROPOSED SUBSTITUTION
NAME, BRAND: _____	_____
CATALOG NO.: _____	_____
MANUFACTURER: _____	_____
VARIATIONS: _____	_____
MAINTENANCE SERVICE AVAILABLE: YES ___ NO ___	
WHERE? _____	
SPARE PARTS SOURCE: _____	

PREVIOUS INSTALLATIONS

ATTACH LIST OF MINIMUM OF 5 PREVIOUS INSTALLATIONS GIVING FOLLOWING DATA REGARDING PROJECTS ON WHICH PROPOSED SUBSTITUTION WAS USED:

PROJECT 1: _____
ADDRESS: _____
ARCHITECT/TEL: _____
OWNER/TEL: _____
DATE INSTALLED: _____
DOLLAR VALUE THIS WORK: _____

PROJECT 2: _____
ADDRESS: _____
ARCHITECT/TEL: _____
OWNER/TEL: _____
DATE INSTALLED: _____
DOLLAR VALUE THIS WORK: _____

PROJECT 3: _____

Mesa County Justice Center 2nd Floor
Renovation

125 N. Spruce Street
Grand Junction, CO 81501

For Construction
08/30/2024

SUBSTITUTION REQUEST
FORM
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ADDRESS: _____
ARCHITECT/TEL: _____
OWNER/TEL: _____
DATE INSTALLED: _____
DOLLAR VALUE THIS WORK: _____

PROJECT 4: _____
ADDRESS: _____
ARCHITECT/TEL: _____
OWNER/TEL: _____
DATE INSTALLED: _____
DOLLAR VALUE THIS WORK: _____

PROJECT 5: _____
ADDRESS: _____
ARCHITECT/TEL: _____
OWNER/TEL: _____
DATE INSTALLED: _____
DOLLAR VALUE THIS WORK: _____

REASON FOR NOT GIVING PRIORITY TO SPECIFIED ITEMS:

EFFECT OF SUBSTITUTION:

PROPOSED SUBSTITUTION AFFECTS OTHER PARTS OF WORK:

NO ___ YES ___ (IF YES, EXPLAIN) _____

SUBSTITUTION CHANGES CONTRACT TIME: NO ___ YES ___

ADD/DEDUCT _____ DAYS

SUBSTITUTION REQUIRES DIMENSIONAL REVISION, REDESIGN OF STRUCTURE OR M&E WORK:

NO ___ YES ___ (IF YES, ATTACH COMPLETE DATA.)

SAVING OR CREDIT TO OWNER, IF ANY, FOR ACCEPTING SUBSTITUTION:

\$ _____.

EXTRA COST TO OWNER, IF ANY, FOR ACCEPTING SUBSTITUTION:

\$ _____.

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CONTRACTOR'S/SUPPLIER'S STATEMENT OF CONFORMANCE OF PROPOSED SUBSTITUTION TO CONTRACT REQUIREMENTS.

I / WE HAVE INVESTIGATED THE PROPOSED SUBSTITUTION.

I / WE:

BELIEVE THAT IT IS EQUAL OR SUPERIOR IN ALL RESPECTS TO SPECIFIED PRODUCT, EXCEPT AS STATED ABOVE. WILL PROVIDE SAME WARRANTY AS SPECIFIED. HAVE INCLUDED COMPLETE COST DATA AND IMPLICATIONS OF SUBSTITUTION. WILL PAY REDESIGN AND SPECIAL INSPECTION COSTS CAUSED BY USE OF THIS PRODUCT WILL PAY ADDITIONAL COSTS TO OTHER CONTRACTORS CAUSED BY SUBSTITUTION. WILL COORDINATE INCORPORATION OF PROPOSED SUBSTITUTION IN WORK. WILL MODIFY OTHER PARTS OF WORK AS MAY BE NEEDED, TO MAKE ALL PARTS OF WORK COMPLETE AND FUNCTIONING. WAIVE FUTURE CLAIMS FOR ADDED COST TO CONTRACT CAUSED BY SUBSTITUTION.

SUPPLIER: _____

DATE: _____

BY: _____

GENERAL CONTRACTOR: _____

DATE: _____

BY: _____

POSITION: _____

COMMENTS:

END OF SECTION

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SECTION 013000 ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General administrative requirements.
- B. Preconstruction meeting.
- C. Progress meetings.
- D. Construction progress schedule.
- E. Coordination drawings.
- F. Requests for Interpretation (RFI) procedures.
- G. Submittal Schedule.
- H. Submittals for review, information, and project closeout.
- I. Number of copies of submittals.
- J. Requests for Interpretation (RFI) procedures.
- K. Submittal procedures.
- L. Submittal review.

1.02 RELATED REQUIREMENTS

- A. Section 016000 - Product Requirements: General product requirements.
- B. Section 017000 - Execution and Closeout Requirements: Additional coordination requirements.
- C. Section 017800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

- A. Comply with requirements of Section 017000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
- B. Make the following types of submittals to Architect and Owner:
 - 1. Requests for Interpretation (RFI).
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples.
 - 4. Test and inspection reports.
 - 5. Design data.
 - 6. Manufacturer's instructions and field reports.
 - 7. Applications for payment and change order requests.
 - 8. Progress schedules.
 - 9. Coordination drawings.
 - 10. Correction Punch List and Final Correction Punch List for Substantial Completion.
 - 11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

- A. Attendance Required:
 - 1. Owner.
 - 2. Architect.
 - 3. Contractor.
- B. Agenda:
 - 1. Execution of Owner-Contractor Agreement.
 - 2. Submission of executed bonds and insurance certificates.
 - 3. Distribution of Contract Documents.

Mesa County Justice Center 2nd Floor
Renovation

125 N. Spruce Street
Grand Junction, CO 81501

For Construction
08/30/2024

Administrative Requirements
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4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
 5. Designation of personnel representing the parties to Contract.
 6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 7. Scheduling.
- C. 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.

3.02 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the work at maximum bi-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 RFIs log and status of responses.
 7. Review of off-site fabrication and delivery schedules.
 8. Maintenance of progress schedule.
 9. Corrective measures to regain projected schedules.
 10. Planned progress during succeeding work period.
 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.

3.03 CONSTRUCTION PROGRESS SCHEDULE

- A. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- B. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- C. Within 10 days after joint review, submit complete schedule.
- D. Submit updated schedule with each Application for Payment.

3.04 COORDINATION DRAWINGS

- A. Review drawings prior to submission to Architect.

3.05 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.

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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. 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 substitutions (see Section - 016000 - Product Requirements)
 - b. Changes that entail change in Contract Time and Contract Sum (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.
- E. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- F. 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.
- G. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.
- 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. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
 2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
 3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.

3.06 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. 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.

3.07 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.

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- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 017800 - Closeout Submittals.

3.08 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.

3.09 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 017800 - 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.

3.10 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. Extra Copies at Project Closeout: See Section 017800.
- C. 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.

3.11 SUBMITTAL PROCEDURES

- A. General Requirements:
 - 1. Use a separate transmittal for each item.
 - 2. Transmit using approved form.
 - 3. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
 - 4. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
 - 5. 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.
 - 6. 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.
 - a. Send submittals in electronic format via email to Architect.
 - 7. 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 30 days.
 - 8. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
 - 9. When revised for resubmission, identify all changes made since previous submission.

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10. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
 11. 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.
 12. Submittals not requested will be recognized, and will be returned "Not Reviewed",
- B. Product Data Procedures:
1. Submit only information required by individual specification sections.
 2. Collect required information into a single submittal.
 3. Submit concurrently with related shop drawing submittal.
 4. 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.

3.12 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. See below for actions to be taken.
- C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.
- D. Architect's and consultants' actions on items submitted for review:
1. Authorizing purchasing, fabrication, delivery, and installation:
 - a. "Approved", or language with same legal meaning.
 - b. "Approved as Noted, Resubmission not required", or language with same legal meaning.
 - 1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
 - c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.
 2. Not Authorizing fabrication, delivery, and installation:
 - a. "Revise and Resubmit".
 - 1) Resubmit revised item, with review notations acknowledged and incorporated.
- E. Architect's and consultants' actions on items submitted for information:
1. Items for which no action was taken:
 - a. "Received for Record" - to notify the Contractor that the submittal has been received for record only.
 2. Items for which action was taken:
 - a. "Reviewed" - no further action is required from Contractor.

END OF SECTION

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SECTION 013553 SECURITY PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Security measures including formal security program, entry control, personnel identification, and miscellaneous restrictions.

1.02 RELATED REQUIREMENTS

- A. Section 011000 - Summary: use of premises and occupancy.
- B. Section 015000 - Temporary Facilities and Controls: Temporary lighting.

1.03 SECURITY PROGRAM

- A. Protect Work , existing premises and Owner's operations from theft, vandalism, and unauthorized entry.
- B. Initiate program in coordination with Owner's existing security system at project mobilization.
- C. Maintain program throughout construction period until Owner occupancy.

1.04 ENTRY CONTROL

- A. Restrict entrance of persons and vehicles into Project site and existing facilities.
- B. Allow entrance only to authorized persons with proper identification. Key card access to worksite area only.
- C. Owner will control entrance of persons and vehicles related to Owner's operations.
- D. No weapons permitted.
- E. Background checks required.
- F. No controlled substances (including but not limited to alcohol, narcotics, etc.)
- G. No audio/ video recording of any type.
- H. Mesa County reserves the right to restrict any type of tools they deem unacceptable.

1.05 PERSONNEL IDENTIFICATION

- A. Provide identification badge to each person authorized to enter premises.
- B. Badge To Include: Personal photograph, name, assigned number , expiration date and employer.
- C. Require return of badges at expiration of their employment on the Work.

1.06 RESTRICTIONS

- A. Do not allow cameras on site or photographs taken except by written approval of Owner.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 014000 QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Submittals.
- B. Testing and inspection agencies and services.
- C. Control of installation.
- D. Tolerances.
- E. Testing and Inspection.
- F. Defect Assessment.

1.02 RELATED REQUIREMENTS

- A. Section 013000 - Administrative Requirements: Submittal procedures.
- B. Section 014216 - Definitions.

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.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.

1.05 TESTING AND INSPECTION AGENCIES AND SERVICES

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

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

3.02 TOLERANCES

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

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- C. Adjust products to appropriate dimensions; position before securing products in place.

3.03 TESTING AND INSPECTION

- A. Testing Agency Duties:
 - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified standards.
 - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
 - 5. Perform additional tests and inspections required by Architect.
 - 6. Submit reports of all tests/inspections specified.
- B. 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.
- C. 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 storage and curing of test samples.
 - 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
 - 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
 - 6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- D. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- E. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.04 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not complying with specified requirements.

END OF SECTION

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SECTION 014216 DEFINITIONS

PART 1 GENERAL

1.01 SUMMARY

- A. Other definitions are included in individual specification sections.

1.02 DEFINITIONS

- A. Furnish: To supply, deliver, unload, and inspect for damage.
- B. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.
- C. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.
- D. Provide: To furnish and install.
- E. Supply: Same as Furnish.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 015000 TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary telecommunications services.
- B. Temporary sanitary facilities.
- C. Temporary Controls: Barriers, enclosures, and fencing.
- D. Security requirements.
- E. Vehicular access and parking.
- F. Waste removal facilities and services.
- G. Project identification sign.
- H. Field offices.

1.02 RELATED REQUIREMENTS

- A. Section 013553 - Security Procedures
- B. Section 015100 - Temporary Utilities.
- C. Section 015500 - Vehicular Access and Parking.
- D. Section 01 57 19 - Temporary Environmental Controls.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

1.04 TELECOMMUNICATIONS SERVICES

- A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

1.05 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Use of existing facilities in other parts of the building is not permitted.
- C. Maintain daily in clean and sanitary condition.

1.06 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 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. Provide protection for plants designated to remain. Replace damaged plants.
- D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.07 FENCING

- A. Provide 6 foot (1.8 m) high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.08 INTERIOR ENCLOSURES

- A. Provide temporary partitions 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.

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- B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:
 - 1. STC rating of 35 in accordance with ASTM E90.
 - 2. Maximum flame spread rating of 75 in accordance with ASTM E84.

1.09 SECURITY - SEE SECTION 013553

- 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.

1.10 VEHICULAR ACCESS AND PARKING - SEE SECTION 015500

- 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. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.
- F. Coordinate with Owner for locations where construction personnel can park during construction.

1.11 WASTE REMOVAL

- A. See Section 017419 - 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.

1.12 FIELD OFFICES

- A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture.
- B. Provide space for Project meetings, with table and chairs to accommodate 8 persons.
- C. Locate offices a minimum distance of 30 feet (10 m) from existing structures.

1.13 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. Restore existing facilities used during construction to original condition.
- E. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 015100 TEMPORARY UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary Utilities: Provision of electricity, lighting, heat, ventilation, and water.

1.02 RELATED REQUIREMENTS

- A. Section 015000 - Temporary Facilities and Controls:
 - 1. Temporary telecommunications services for administrative purposes.
 - 2. Temporary sanitary facilities required by law.

1.03 REFERENCE STANDARDS

- A. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.

1.04 TEMPORARY ELECTRICITY

- A. Cost: By Owner.
- B. Connect to Owner's existing power service.
 - 1. Do not disrupt Owner's need for continuous service.
 - 2. Exercise measures to conserve energy.
- C. Provide temporary electric feeder from existing building electrical service at location as directed.
- D. Complement existing power service capacity and characteristics as required.
- E. Provide power outlets for construction operations, with branch wiring and distribution boxes located as required. Provide flexible power cords as required.
- F. Provide feeder switch at source distribution equipment and meter.
- G. Permanent convenience receptacles may be utilized during construction.
- H. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.

1.05 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

- A. Provide and maintain LED lighting as suitable for the application for construction operations in accordance with requirements of 29 CFR 1926 and authorities having jurisdiction.
- B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- C. Maintain lighting and provide routine repairs.
- D. Permanent building lighting may be utilized during construction.

1.06 TEMPORARY HEATING

- A. Cost of Energy: By Owner.
- B. Provide heating devices and heat as needed to maintain specified conditions for construction operations.
- C. Maintain minimum ambient temperature of 50 degrees F (10 degrees C) in areas where construction is in progress, unless indicated otherwise in specifications.
- D. Owner's existing heat plant may be used.
 - 1. Exercise measures to conserve energy.
 - 2. Enclose building prior to activating temporary heat.
- E. Prior to operation of permanent equipment for temporary heating purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

1.07 TEMPORARY COOLING

- A. Cost of Energy: By Owner.

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- B. Provide cooling devices and cooling as needed to maintain specified conditions for construction operations.
- C. Maintain maximum ambient temperature of 80 degrees F (26 degrees C) in areas where construction is in progress, unless indicated otherwise in specifications.
- D. Owner's existing cooling plant may be used.
 - 1. Exercise measures to conserve energy.
 - 2. Enclose building prior to activating temporary cooling.
- E. Prior to operation of permanent equipment for temporary cooling purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

1.08 TEMPORARY VENTILATION

- A. Utilize existing ventilation equipment. Extend and supplement equipment with temporary fan units as required to maintain clean air for construction operations.

1.09 TEMPORARY WATER SERVICE

- A. Cost of Water Used: By Owner.
- B. Connect to existing water source.
 - 1. Exercise measures to conserve water.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 015500 VEHICULAR ACCESS AND PARKING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Access roads.
- B. Parking.
- C. Existing pavements and parking areas.
- D. Permanent pavements and parking facilities.
- E. Construction parking controls.
- F. Traffic signs and signals.
- G. Maintenance.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 ACCESS ROADS

- A. Use of designated existing on-site streets and driveways for construction traffic is permitted.
- B. Provide unimpeded access for emergency vehicles. Maintain 20 foot (6 m) width driveways with turning space between and around combustible materials.
- C. Provide and maintain access to fire hydrants free of obstructions.

3.02 PARKING

- A. Use of designated areas of existing parking facilities by construction personnel is permitted.
- B. Arrange for temporary parking areas to accommodate use of construction personnel.
- C. When site space is not adequate, provide additional off-site parking.

3.03 PERMANENT PAVEMENTS AND PARKING FACILITIES

- A. Avoid traffic loading beyond paving design capacity. Tracked vehicles not allowed.

3.04 CONSTRUCTION PARKING CONTROL

- A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and Owner's operations.
- B. Monitor parking of construction personnel's vehicles in existing facilities. Maintain vehicular access to and through parking areas.
- C. Prevent parking on or adjacent to access roads or in non-designated areas.

3.05 TRAFFIC SIGNS AND SIGNALS

- A. At approaches to site and on site, install at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.
- B. Relocate as work progresses, to maintain effective traffic control.

3.06 MAINTENANCE

- A. Maintain traffic and parking areas in a sound condition free of excavated material, construction equipment, products, mud, snow, and ice.
- B. Maintain existing paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.

END OF SECTION

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SECTION 015719 TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Construction procedures to promote adequate indoor air quality after construction.

1.02 PROJECT GOALS

- A. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.
 - 1. Cleaning of ductwork is not contemplated under this Contract.
 - 2. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.
- B. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.
 - 1. Furnish products meeting the specifications.
 - 2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

1.03 REFERENCE STANDARDS

- A. SMACNA (OCC) - IAQ Guidelines for Occupied Buildings Under Construction; 2007.

1.04 DEFINITIONS

- A. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.
- B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.
- C. Particulates: Dust, dirt, and other airborne solid matter.
- D. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONSTRUCTION PROCEDURES

- A. Prevent the absorption of moisture and humidity by adsorptive materials by:
 - 1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.
 - 2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
 - 3. Provide sufficient ventilation for drying within reasonable time frame.
- B. Begin construction ventilation when building is substantially enclosed.
- C. Do not store construction materials or waste in mechanical or electrical rooms.
- D. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.
 - 1. Inspect duct intakes, return air grilles, and terminal units for dust.
 - 2. Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes and conduit.
 - 3. Clean tops of doors and frames.
 - 4. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.
 - 5. Clean return plenums of air handling units.
 - 6. Remove intake filters last, after cleaning is complete.
- E. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.

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- F. Use other relevant recommendations of SMACNA (OCC) for avoiding unnecessary contamination due to construction procedures.

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SECTION 016000 PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Re-use of existing products.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations.
- E. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

- A. Section 012500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
- B. Section 014000 - Quality Requirements: Product quality monitoring.
- C. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.
- D. Section 017419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.03 SUBMITTALS

- A. 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.
- B. 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.
- C. 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.
- D. For products to match existing confirm existing finish on site and submit samples that match existing as closely as possible. include a photo of the submitted item adjacent to the existing finish being matched as part of the submittal.

PART 2 PRODUCTS

2.01 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.
- D. Specific Products to be Reused: The reuse of certain materials and equipment already existing on the project site is required.
 - 1. See drawings for items required to be salvaged for reuse and relocation.
 - 2. If reuse of other existing materials or equipment is desired, submit substitution request.

2.02 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. See Section 014000 - Quality Requirements, for additional source quality control requirements.

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- C. 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.
- D. Where other criteria are met, Contractor shall give preference to products that:
 - 1. If used on interior, have lower emissions.
 - 2. If wet-applied, have lower VOC content, .
 - 3. Are extracted, harvested, and/or manufactured closer to the location of the project.

2.03 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.
- D. Products called out to match existing: provide same product as existing if possible.

2.04 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 012500 - Substitution Procedures.

3.02 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.

3.03 STORAGE AND PROTECTION

- A. Provide protection of stored materials and products against theft, casualty, or deterioration.
- B. Any storage area needs to be approved by Owner. Storage of materials onsite may not be permitted. If permitted and approved, 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 017419.
- C. Store and protect products in accordance with manufacturers' instructions.
- D. Store with seals and labels intact and legible.
- E. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

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- F. For exterior storage of fabricated products, place on sloped supports above ground.
- 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. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- J. Prevent contact with material that may cause corrosion, discoloration, or staining.
- K. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- L. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

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SECTION 016116 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 DEFINITIONS

- A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:
- 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.
- 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.

1.03 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; 2005 (Reapproved 2018).
- C. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2020.
- D. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).
- E. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

1.04 SUBMITTALS

- A. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

1.05 QUALITY ASSURANCE

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

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PART 2 PRODUCTS

2.01 MATERIALS

- A. 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).

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

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

END OF SECTION

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SECTION 017000 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.
- C. Pre-installation meetings.
- D. Cutting and patching.
- E. Surveying for laying out the work.
- F. Cleaning and protection.
- G. Starting of systems and equipment.
- H. Demonstration and instruction of Owner personnel.
- I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- J. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

- A. Section 014000 - Quality Requirements: Testing and inspection procedures.
- B. Section 015000 - Temporary Facilities and Controls: Temporary exterior enclosures.
- C. Section 015000 - Temporary Facilities and Controls: Temporary interior partitions.
- D. Section 017610 - Temporary Protective Coverings: Materials for protection of installed work.
- E. Section 017800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.
- F. Section 017900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
 - 1. On request, submit documentation verifying accuracy of survey work.
 - 2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
 - 3. Submit surveys and survey logs for the project record.
- C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
 - 1. Structural integrity of any element of Project.
 - 2. Integrity of weather exposed or moisture resistant element.
 - 3. Efficiency, maintenance, or safety of any operational element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Work of Owner or separate Contractor.

1.04 QUALIFICATIONS

- A. For demolition work, employ a firm specializing in the type of work required.
- B. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,
- C. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

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1.05 PROJECT CONDITIONS

- A. Use of explosives is not permitted.
- B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- C. Perform dewatering activities, as required, for the duration of the project.
- D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- E. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
 - 1. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.
 - 2. Indoors: Limit conduct of especially noisy interior work to the hours of 6 pm to 7 am.
- F. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.06 COORDINATION

- A. 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.
- B. Notify affected utility companies and comply with their requirements.
- C. 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.
- D. 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.
- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.
- G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.
- H. Any correction work will need to be completed after hours or on weekend unless specifically approved otherwise by Owner.

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 016000 - 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.

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- 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 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of examination, preparation and installation procedures.
 - 2. Review coordination with related 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 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- F. Utilize recognized engineering survey practices.
- G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
 - 2. Grid or axis for structures.
 - 3. Building foundation, column locations, ground floor elevations.
- H. Periodically verify layouts by same means.
- I. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 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.

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- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 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. Keep areas in which alterations are being constructed separate from other areas that are still occupied. Provide, erect, and maintain temporary dustproof partitions.
- C. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove items indicated on drawings.
 - 2. Relocate items indicated on drawings.
 - 3. 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.
 - 4. 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. 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. 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.
 - 2. 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.
- 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.

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- L. Comply with all other applicable requirements of this section.

3.07 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 original 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 078400, 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.

3.08 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.

3.09 PROTECTION OF INSTALLED WORK

- A. See Section 017610 for temporary protective covering materials.
- B. Protect installed work from damage by construction operations.
- C. Provide special protection where specified in individual specification sections.
- D. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- E. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- F. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- G. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.

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- H. 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.
- I. Prohibit traffic from landscaped areas.
- J. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems.
- B. 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.
- C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- D. Verify that wiring and support components for equipment are complete and tested.
- E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

- A. See Section 017900 - Demonstration and Training.

3.12 ADJUSTING

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

3.13 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, gutters, downspouts, scuppers, overflow drains, area drains, 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.

3.14 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
 - 1. Provide copies to Architect.
- 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.

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- F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
- H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.15 MAINTENANCE

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

END OF SECTION

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SECTION 017419 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

- A. Owner requires that this project generate the least amount of trash and waste possible.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- D. 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 013000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. Section 015000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.
- C. Section 016000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
- D. Section 017000 - 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.

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- 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 013000 - Administrative Requirements, for submittal procedures.

PART 2 PRODUCTS

2.01 PRODUCT SUBSTITUTIONS

- A. See Section 016000 - Product Requirements for substitution submission procedures.
- B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 016000:
 - 1. Relative amount of waste produced, compared to specified product.
 - 2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Price.
 - 3. Proposed disposal method for waste product.

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

- A. See Section 013000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. See Section 015000 for additional requirements related to trash/waste collection and removal facilities and services.
- C. See Section 016000 for waste prevention requirements related to delivery, storage, and handling.
- D. See Section 017000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- B. Meetings: Discuss trash/waste management goals and issues at project meetings.
 - 1. Prebid meeting.
 - 2. Preconstruction meeting.
 - 3. Regular job-site meetings.
- C. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
 - 1. Provide containers as required.
 - 2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
 - 3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- D. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
- E. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
- F. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.
- G. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

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H. Remove trash from site on a daily basis.

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SECTION 017610 TEMPORARY PROTECTIVE COVERINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary protective coverings for installed floors, walls, and other surfaces.

1.02 RELATED REQUIREMENTS

- A. Section 017000 - Execution and Closeout Requirements: Coordination of requirements for materials specified in this section.

1.03 REFERENCE STANDARDS

- A. ANSI A135.4 - Basic Hardboard; 2012 (Reaffirmed 2020).
- B. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board; 2022.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.

PART 2 PRODUCTS

2.01 GENERAL

- A. Provide materials that are easily removed without damage to the surfaces covered and with the following characteristics:
 - 1. Water resistant.
 - 2. Vapor permeable.
 - 3. Impact resistant.

2.02 MATERIALS

- A. Sheet Materials:
 - 1. Recycled paperboard/plastic composite sheet.
 - 2. Recycled paperboard sheet.
 - 3. Wood Hardboard: ANSI A135.4, tempered, 1/4 inch (6 mm) thick nominal.
 - 4. Plywood, 1/2 inch (13 mm) thick nominal.
 - 5. Fiberboard: ASTM C208, 1/2 inch (13 mm) thick nominal.
 - 6. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
- B. Rolled Materials:
 - 1. Self-adhering polyethylene film.
 - 2. Recycled cellulose fiberboard paper.
 - 3. Laminated glass fiber reinforced kraft paper.
- C. Corner and Door Jamb Protection Materials:
 - 1. Cardboard, shaped specifically for application.

PART 3 EXECUTION

3.01 PREPARATION

- A. Remove dirt and debris from surfaces to be protected.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Trim or overlap sheet materials to fit area to be covered.
- C. Roll out and cut rolled materials to fit area to be covered.
- D. Tape seams. Avoid taping directly to finished surfaces.
- E. Stretch self-adhering film materials to completely cover surface.
- F. Install door jamb protection to full height of opening.

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3.03 REMOVAL

- A. Remove protective coverings prior to Date of Substantial Completion. Reuse or recycle materials if possible.

END OF SECTION

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SECTION 017800 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 013000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- B. Section 017000 - Execution and Closeout Requirements: Contract closeout procedures.
- C. Individual Product Sections: Specific requirements for operation and maintenance data.
- D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and modifications.

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- 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:
- 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.

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- L. Include test and balancing reports.
- M. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Included hardcopy documents as well as a digital version, supplied to the owner on an USB drive.
- C. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- D. 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.
- E. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- F. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- G. 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.
- H. 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.
- I. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.
- J. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- K. Drawings: Provide electronic copies of drawings included in manuals in appropriate sections.

3.06 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. 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

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SECTION 017900 DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

- A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.
- B. Training of Owner personnel in operation and maintenance is required for:
 - 1. All software-operated systems.
 - 2. HVAC systems and equipment.
 - 3. Plumbing equipment.
 - 4. Electrical systems and equipment.
 - 5. Landscape irrigation.
 - 6. Items specified in individual product Sections.
- C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
 - 1. Finishes, including flooring, wall finishes, ceiling finishes.
 - 2. Fixtures and fittings.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures; except:
 - 1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.
 - 2. Submit one copy to the Commissioning Authority, not to be returned.
 - 3. Make commissioning submittals on time schedule specified by Commissioning Authority.
 - 4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.
- B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
 - 1. Submit to Commissioning Authority for review and inclusion in overall training plan.
 - 2. Submit not less than four weeks prior to start of training.
 - 3. Revise and resubmit until acceptable.
 - 4. Provide an overall schedule showing all training sessions.
 - 5. Include at least the following for each training session:
 - a. Identification, date, time, and duration.
 - b. Description of products and/or systems to be covered.
 - c. Name of firm and person conducting training; include qualifications.
 - d. Intended audience, such as job description.
 - e. Objectives of training and suggested methods of ensuring adequate training.
 - f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
 - g. Media to be used, such as slides, hand-outs, etc.
 - h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.
- C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
 - 1. Include applicable portion of O&M manuals.
 - 2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
 - 3. Provide one extra copy of each training manual to be included with operation and maintenance data.

1.03 QUALITY ASSURANCE

- A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
 - 1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
 - 2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

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PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
- B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.
- C. Demonstration may be combined with Owner personnel training if applicable.
- D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
 - 1. Perform demonstrations not less than two weeks prior to Substantial Completion.
 - 2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
 - 1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

- A. Commissioning Authority will prepare the Training Plan based on draft plans submitted.
- B. Conduct training on-site unless otherwise indicated.
- C. Owner will provide classroom and seating at no cost to Contractor.
- D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.
- E. Provide training in minimum two hour segments.
- F. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.
- G. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.
- H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
 - 1. The location of the O&M manuals and procedures for use and preservation; backup copies.
 - 2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
 - 3. Typical uses of the O&M manuals.
- I. Product- and System-Specific Training:
 - 1. Review the applicable O&M manuals.
 - 2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
 - 3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
 - 4. Provide hands-on training on all operational modes possible and preventive maintenance.
 - 5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
 - 6. Discuss common troubleshooting problems and solutions.
 - 7. Discuss any peculiarities of equipment installation or operation.
 - 8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
 - 9. Review recommended tools and spare parts inventory suggestions of manufacturers.
 - 10. Review spare parts and tools required to be furnished by Contractor.
 - 11. Review spare parts suppliers and sources and procurement procedures.

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- J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

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SECTION 024100 DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Selective demolition of built site elements.
- B. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS

- A. Section 011000 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 015000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- C. Section 017000 - 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.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. 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.
 - 3. Provide, erect, and maintain temporary barriers and security devices.
 - 4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 5. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
 - 6. 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.
 - 7. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. 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.
- D. 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.
- E. Hazardous Materials:
 - 1. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCBs, and mercury.

3.02 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. Remove existing work as indicated and required to accomplish new work.
 - 1. Remove items indicated on drawings.

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- C. Services including, but not limited to, HVAC, Plumbing, Electrical, and Telecommunications: Remove existing systems and equipment as indicated.
 - 1. Maintain existing active systems to remain in operation, and maintain access to equipment and operational components.
 - 2. 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.
 - 3. Verify that abandoned services serve only abandoned facilities before removal.
 - 4. 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.
- D. 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.

3.03 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

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SECTION 035400 CAST UNDERLAYMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Liquid-applied self-leveling floor underlayment.

1.02 REFERENCE STANDARDS

- A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens); 2021.
- B. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2022.
- C. ASTM C348 - Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars; 2021.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data sheets documenting physical characteristics and product limitations of underlayment materials. Include information on surface preparation, environmental limitations, and installation instructions.
- C. Manufacturer's Instructions.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Keep dry and protect from direct sun exposure, freezing, and ambient temperature greater than 105 degrees F (41 degrees C).

1.05 FIELD CONDITIONS

- A. Do not install underlayment until floor penetrations and peripheral work are complete.
- B. Maintain minimum ambient temperatures of 50 degrees F (10 degrees C) 24 hours before, during and 72 hours after installation of underlayment.
- C. During the curing process, ventilate spaces to remove excess moisture.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Cementitious Underlayment:
 - 1. ARDEX Engineered Cements; ARDEX K 13 with ARDEX P51 Primer: www.ardexamericas.com/#sle.
 - 2. Custom Building Products; CL-150 Self-Leveling Underlayment: www.custombuildingproducts.com/#sle.
 - 3. LATICRETE International, Inc; LATICRETE NXT LEVEL PLUS WITH NXT PRIMER: www.laticrete.com/#sle.
 - 4. Mapei Corporation; PlaniLevel 450: www.mapei.com/#sle.
 - 5. Substitutions: See Section 016000 - Product Requirements.

2.02 MATERIALS

- A. Cementitious Underlayment: Blended cement mix, that when mixed with water in accordance with manufacturer's directions will produce self-leveling underlayment with the following properties:
 - 1. Compressive Strength: Minimum 4000 pounds per square inch (27.6 MPa) after 28 days, tested per ASTM C109/C109M.
 - 2. Flexural Strength: Minimum 1000 psi (6.9 MPa) after 28 days, tested per ASTM C348.
 - 3. Density: 125 pounds per cubic foot (2002 kg/cu m), nominal.
 - 4. Final Set Time: 1-1/2 to 2 hours, maximum.
 - 5. Thickness: Capable of thicknesses from feather edge to maximum 3-1/2 inch (89 mm).

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6. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0 in accordance with ASTM E84.
- B. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to underlayment mix materials.
- C. Primer: Manufacturer's recommended type.
- D. Joint and Crack Filler: Latex-based filler, as recommended by manufacturer.

2.03 MIXING

- A. Site mix materials in accordance with manufacturer's instructions.
- B. Mix to self-leveling consistency without over-watering.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate.

3.02 PREPARATION

- A. Remove substrate surface irregularities. Fill voids and deck joints with filler. Finish smooth.
- B. Vacuum clean surfaces.
- C. Prime substrate in accordance with manufacturer's instructions. Allow to dry.
- D. Close floor openings.

3.03 APPLICATION

- A. Install underlayment in accordance with manufacturer's instructions.
- B. Place to indicated thickness, with top surface level to 1/8 inch in 10 ft (1:1000).

3.04 CURING

- A. Once underlayment starts to set, prohibit foot traffic until final set has been reached.
- B. Air cure in accordance with manufacturer's instructions.

3.05 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field inspection and testing, as specified in Section 014000 - Quality Requirements.
- B. Placed Material: Agency will inspect and test for compliance with specification requirements.

3.06 PROTECTION

- A. Protect against direct sunlight, heat, and wind; prevent rapid drying to avoid shrinkage and cracking.
- B. Do not permit traffic over unprotected floor underlayment surfaces.

END OF SECTION

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SECTION 042000 UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete block.
- B. Mortar and grout.
- C. Reinforcement and anchorage.
- D. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 079200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

- A. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.
- B. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019.
- C. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2022.
- D. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.
- E. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2022.
- F. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.
- G. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.
- H. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.
- I. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.
- J. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2018.
- K. ASTM C476 - Standard Specification for Grout for Masonry; 2023.
- L. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata.
- M. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
- C. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, size and type of fasteners, and accessories for brickwork support system.

1.05 QUALITY ASSURANCE

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
- B. Fire Rated Assemblies: Comply with applicable code for UL (FRD) Assembly No. as shown in drawings.
- C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of experience.
- D. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

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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 depth of 8 inches (200 mm).
 - 2. Nonloadbearing Units: ASTM C129.
 - a. Hollow block, as indicated.
 - b. Lightweight.

2.02 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Mortar Aggregate: ASTM C144.
- D. Grout Aggregate: ASTM C404.
- E. Water: Clean and potable.

2.03 REINFORCEMENT AND ANCHORAGE

- A. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi) (280 MPa), deformed billet bars; uncoated.
- B. Single Wythe Joint Reinforcement: ASTM A951/A951M.
 - 1. Type: Truss or ladder.
 - 2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M Class 3.
 - 3. Size: 0.1875 inch (4.8 mm) side rods with 0.1875 inch (4.8 mm) cross rods; width as required to provide not less than 5/8 inch (16 mm) of mortar coverage on each exposure.

2.04 ACCESSORIES

- A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
- B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; in maximum lengths available.
- C. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.05 MORTAR AND GROUT MIXING

- A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
 - 1. Interior, non-loadbearing masonry: Type N.
- 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. 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 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

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:

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1. Bond: Running.
2. Coursing: One unit and one mortar joint to equal 8 inches (200 mm).
3. Mortar Joints: Concave.

3.04 PLACING AND BONDING

- A. Lay hollow masonry units with face shell bedding on head and bed joints.
- B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- C. Remove excess mortar and mortar smears as work progresses.
- D. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

3.05 REINFORCEMENT AND ANCHORAGE - SINGLE WYTHE MASONRY

3.06 LINTELS

- A. Install loose steel lintels over openings.

3.07 GROUTED COMPONENTS

- A. Lap splices minimum 24 bar diameters.
- B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.
- C. Place and consolidate grout fill without displacing reinforcing.

3.08 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.

3.09 TOLERANCES

- A. 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.
- B. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.
- C. 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).
- D. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch (minus 6.4 mm, plus 9.5 mm).

3.10 CUTTING AND FITTING

- A. Cut and fit for pipes, conduit, and sleeves. Coordinate with other sections of work to provide correct size, shape, and location.

3.11 CLEANING

- A. Clean soiled surfaces with cleaning solution.

3.12 PROTECTION

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

END OF SECTION

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SECTION 055213 PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Stair railings and guardrails.
- B. Free-standing railings at steps.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Placement of anchors in concrete.
- B. Section 092116 - Gypsum Board Assemblies: Placement of backing plates in stud wall construction.
- C. Section 099123 - Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
- C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021a.
- D. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.
- E. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2021.
- F. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- G. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel; 2017, with Amendment (2021).
- H. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

PART 2 PRODUCTS

2.01 MANUFACTURERS

Handrails and Railings:

- 1. Custom Manufactured.

Substitutions: See Section 016000 - Product Requirements.

2.02 RAILINGS - GENERAL REQUIREMENTS

- A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.
- B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot (1095 N/m) applied to the top of the assembly and in any direction, without damage or permanent set.
- C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds (890 N) applied at any point on the top of the assembly and in any direction, without damage or permanent set.
- D. Allow for expansion and contraction of members and building movement without damage to connections or members.
- E. Dimensions: See drawings for configurations and heights.
 - 1. Top Rails and Wall Rails: 1-1/2 inches (38 mm) diameter, round.

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Renovation

125 N. Spruce Street
Grand Junction, CO 81501

For Construction
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Pipe and Tube Railings
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2. Posts: 1-1/2 inches (38 mm) diameter, round.
- F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
 1. For anchorage to concrete, provide inserts to be cast into concrete, for bolting anchors.
 2. For anchorage to stud walls, provide backing plates, for bolting anchors.
- G. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.
- H. Welded and Brazed Joints: Make visible joints butt tight, flush, and hairline; use methods that avoid discoloration and damage of finish; grind smooth, polish, and restore to required finish.
 1. Ease exposed edges to a small uniform radius.
 2. Welded Joints:
 - a. Carbon Steel: Perform welding in accordance with AWS D1.1/D1.1M.
 - b. Stainless Steel: Perform welding in accordance with AWS D1.6/D1.6M.

2.03 STEEL RAILING SYSTEM

- A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.
- B. Steel Pipe: ASTM A53/A53M Grade B Schedule 80, black finish.
- C. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.
- D. Exposed Fasteners: No exposed bolts or screws.
- E. Straight Splice Connectors: Steel welding collars.
- F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.04 FABRICATION

- A. Accurately form components to suit specific project conditions and for proper connection to building structure.
- B. Fit and shop assemble components in largest practical sizes for delivery to site.
- C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.
- D. Welded Joints:
 1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
 2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
 3. 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.
- E. Weld connections that cannot be shop welded due to size limitations.
 1. Weld in accordance with AWS D1.1/D1.1M.
 2. Match shop welding and bolting.
 3. Clean welds, bolted connections, and abraded areas.
 4. Touch up shop primer and factory-applied finishes.
 5. Repair galvanizing with galvanizing repair paint per ASTM A780/A780M.

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 in accordance with manufacturer's instructions.

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- B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
- C. Install railings in compliance with ADA Standards for accessible design at applicable locations.
- D. Anchor railings securely to structure.
- E. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6 mm) per floor level, 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

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SECTION 061000 ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-structural dimension lumber framing.
- B. Fire retardant treated wood materials.
- C. Communications and electrical room mounting boards.
- D. Concealed wood blocking, nailers, and supports.

REFERENCE STANDARDS

- E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- G. AWPA U1 - Use Category System: User Specification for Treated Wood; 2023.
- H. PS 1 - Structural Plywood; 2019.
- I. PS 20 - American Softwood Lumber Standard; 2021.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide technical data on application instructions and fire retardant materials.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

1.04 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

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 any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
 - 2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
- B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Sizes: Nominal sizes as indicated on drawings, S4S.
- B. Moisture Content: S-dry or MC19.
- C. Stud Framing (2 by 2 through 2 by 6 (50 by 50 mm through 50 by 150 mm)):
 - 1. Grade: No. 2.
- D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 2 or Standard Grade.
 - 2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

- A. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

Mesa County Justice Center 2nd Floor
Renovation

125 N. Spruce Street
Grand Junction, CO 81501

For Construction
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2.04 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
 - 2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.

2.05 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 - 1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
- B. Fire Retardant Treatment:
 - 1. Manufacturers:
 - a. Lonza Group: www.wolmanizedwood.com/#sle.
 - b. Hoover Treated Wood Products, Inc: www.frtw.com/#sle.
 - c. Koppers, Inc: www.koppersperformancechemicals.com/#sle.
 - d. Viance, LLC: www.treatedwood.com/#sle.
 - e. Substitutions: See Section 016000 - Product Requirements.
- C. Locations:
 - 1. All wood in interior walls to be fire retardant treated, including but not limited to
 - a. Studs
 - b. Blocking.

PART 3 EXECUTION

3.01 PREPARATION

- A. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

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

3.03 FRAMING INSTALLATION

- A. Set members level, plumb, and true to line. Discard pieces with defects that would lower required strength.
- B. Install structural members full length without splices.
- C. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes.
- D. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.04 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

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.

Provide the following specific non-structural framing and blocking:

- 1. Cabinets and shelf supports.
- 2. Wall brackets.
Handrails.
- 3. Grab bars.
- 4. Towel and bath accessories.
- 5. Wall-mounted door stops.

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6. Wall paneling and trim.
7. Joints of rigid wall coverings that occur between studs.
8. In-wall for LCD screen mounting..
9. Other areas as indicated or required.

3.05 INSTALLATION OF CONSTRUCTION PANELS

- A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.
 1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
 3. Install adjacent boards without gaps.
 4. Size: 48 by 96 inches (2440 by 4880 mm), installed horizontally at ceiling height.

3.06 CLEANING

- A. Waste Disposal: Comply with the requirements of Section 017419 - 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 any 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

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SECTION 062000 FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Finish carpentry items.
- B. Wood trim.

REFERENCE STANDARDS

- C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data:
 - 1. Provide manufacturer's product data, storage and handling instructions for factory-fabricated units.
- C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.
 - 2. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
- D. Samples: Submit two samples of wood trim/base 12 inches long.

1.03 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum three years of experience.
 - 1. Company with at least one project within the past 5 years with value of woodwork within 20 percent of cost of woodwork for this project.
 - 2. Single Source Responsibility: Provide and install this work from single fabricator.
- B. Quality Certification:
 - 1. Comply with AWI (QCP) wood work association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle. Labeling and certification document submittal is not required, but fabricator shall follow AWI guidelines for Premium Grade Millwork.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.
- B. Protect from moisture damage.
- C. Handle materials and products to prevent damage to edges, ends, or surfaces.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

- A. Quality Standard: Premium Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.
- C. Interior Woodwork Items:
 - 1. Door and Miscellaneous Trim: Match wood type and finish of existing courtrooms. Assumed to be clear finished quarter sawn red oak, provide samples for confirmation.

2.02 LUMBER MATERIALS

- A. Hardwood Lumber: Red Oak species, quarter sawn, maximum moisture content of 6 percent ; with vertical grain , of quality suitable for transparent finish.

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2.03 FASTENINGS

- A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.
- B. Fasteners: Of size and type to suit application; Install trim with blind fasteners.
- C. Concealed Joint Fasteners: Threaded steel.

2.04 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Primer: As recommended by manufacturer for top coat.
- C. Wood Filler: Compatible with primer/top coat, tinted to match surface finish color.

2.05 FABRICATION

- A. Shop assemble work for delivery to site, permitting passage through building openings.
- B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

2.06 SHOP FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. Apply wood filler in exposed nail and screw indentations.
- C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.
- D. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
 - 1. Transparent:
 - a. System - 2, Lacquer, Precatalyzed.
 - b. Stain: To Match Existing.
 - c. Sheen: To Match Existing.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

- A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Set and secure materials and components in place, plumb and level.
- C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim to conceal larger gaps.

3.03 TOLERANCES

- A. Maximum Variation from True Position: 1/16 inch (1.6 mm).
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.79 mm).

END OF SECTION

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SECTION 064200 WOOD PANELING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Custom wood veneer paneling.
- B. Shop finishing.

REFERENCE STANDARDS

- C. ANSI A208.1 - American National Standard for Particleboard; 2022.
- D. AWI (QCP) - Quality Certification Program; Current Edition.
- E. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- F. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.
 - 2. Provide plan of panel number sequencing.
- C. Samples: Submit two samples of finished wood panel, 6 x 6 inch (152 x 152 mm) in size, illustrating wood grain and specified finish.

1.03 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of experience.
- B. Quality Certification:
 - 1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle. Certification of project not required, intent is to follow guidelines only.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Protect work from moisture damage.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Comply with applicable codes for fire-retardant requirements.

2.02 PANELING

- A. Quality Standard: Premium Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless otherwise indicated.
- B. Flat Paneling:
 - 1. Species: Red Oak.
 - 2. Cut: Quarter Sawn.
 - 3. Panels: Veneer of full width and balanced sequence matched.
 - 4. Visible Edges and Reveals: Filled and painted.
 - 5. Outside Corners: Mitered and splined.
 - 6. Finish: Transparent.

2.03 WOOD-BASED MATERIALS - GENERAL

- A. Provide sustainably harvested wood, certified or labeled as specified in Section 016000.
- B. Provide wood harvested within a 500 mile (805 km) radius of the project site.

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Particleboard: Composed of wood chips, medium density, with waterproof resin binders; of grade to suit application; sanded faces; complying with ANSI A208.1. Fire retardant treated.

2.04 ADHESIVES AND FASTENERS

- A. Adhesives: Type suitable for intended purpose, complying with applicable air quality regulations.
- B. Fasteners: Of size and type to suit application. All fasteners to be concealed.

2.05 FABRICATION

- A. Prepare panels for delivery to site, permitting passage through building openings.
- B. Finish exposed edges of panels as specified by grade requirements.
- C. When necessary to cut and fit on site, provide materials with ample allowance for cutting and scribing.

2.06 SHOP FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. Apply wood filler in exposed nail and screw indentations.
- C. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
 - 1. Transparent:
 - a. System - 2, Lacquer, Precatalyzed.
 - b. Stain: Match existing.
 - c. Sheen: Match existing.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated on shop drawings.
- B. Verify that existing reveal dimensions are as indicated on shop drawings.
- C. Verify adequacy of backing and support framing.

3.02 INSTALLATION

- A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Do not begin installation until wood materials have been fully acclimated to interior conditions.
- C. Set and secure materials and components in place, plumb and level, using concealed fasteners wherever possible.
- D. Where necessary to cut and fit on site, scribe work abutting other components. Do not use additional overlay trim to conceal gaps.

3.03 TOLERANCES

- A. Maximum Variation from True Position: 1/16 inch (1.6 mm).
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.8 mm).

END OF SECTION

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SECTION 066100 CAST POLYMER FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Solid surfacing fabrications.
- B. Quartz surfacing fabrications.

1.02 RELATED REQUIREMENTS

- A. Section 079200 - Joint Sealants.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- B. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
- C. ISFA 3-01 - Classification and Standards for Quartz Surfacing Material; 2013.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Plans, Elevations, and Sections: Include shapes and dimensions; indicate location of fabricated units.
 - a. Drawing Scale: 1/4 inch to 1 foot (1:50), minimum.
- C. Samples: For each product type, two samples, 12 inches (300 mm) in length, indicating specified color.
- D. Test Reports: Indicate compliance with reference standard performance requirements.
- E. Operation and Maintenance Data: Maintenance instructions, including recommended cleaning procedures and materials.
 - 1. Include instructions for stain removal.

1.05 QUALITY ASSURANCE

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

1.06 DELIVERY, STORAGE, AND HANDLING

- A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Handle products to prevent damage to edges, ends, or surfaces, and in accordance with manufacturer's written instructions.

1.07 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Finish Warranty: Provide 5-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Solid Surface Fabrications:
 - 1. Livingstone Surfaces: www.liviingstonesurfaces.com.
 - 2. HIMACS LX Hausys: www.lxhausys.com.
 - 3. Substitutions: See Section 016000 - Product Requirements.
- B. Quartz Surfacing Fabrications:
 - 1. Cesarstone: www.cesarstoneus.com.
 - 2. Substitutions: See Section 016000 - Product Requirements.

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2.02 REGULATORY REQUIREMENTS

- A. Surface Burning Requirements:
 - 1. Interior Use: Flame spread index of 75 or less and smoke-development index of 450 or less; Class A interior finish classification when tested in accordance with ASTM E84.

2.03 SOLID SURFACING FABRICATIONS

- A. Solid Surfacing (SSM): Densified, homogeneous, nonporous castings fabricated into sheets; composed of acrylic resins, fillers, color chips, and pigment and performance-enhancing additives.
 - 1. Standard Type: Comply with minimum performance and engineering properties of ISFA 2-01.
- B. Applications: Window sills.
 - 1. Style: As indicated on drawings.
 - 2. Thickness: 1/2 inch (12.7 mm).
 - 3. Edge Profile at Horizontal Joints: Manufacturer's standard for application.
 - 4. Edge Profile at Vertical Joints: Manufacturer's standard for application.
 - 5. Finish on Exposed Surfaces: Manufacturer's standard for application.
 - 6. Color: As selected from manufacturer's standard range of colors.

2.04 QUARTZ SURFACING FABRICATIONS

- A. Quartz Surfacing (ST-1): Surfacing materials composed of natural quartz particles, reacted monomers and resins, pigments, and performance-enhancing additives; manufactured as slabs of various thicknesses.
- B. Applications: Wall panels.
 - 1. Type: Slabs.
 - a. Comply with minimum performance and engineering properties of ISFA 3-01.
 - b. Thickness: 25/32 inch (2 cm).
 - 2. Finish: Polished.
 - 3. Color: 5003 Piatra Gray.
 - 4. Exposed Edge Profile: Chamfered.
 - 5. Height: As indicated on drawings.
 - 6. Width: As indicated on drawings.

2.05 FABRICATION

- A. Fabricate cutouts where indicated.
- B. Provide consistent finish over exposed surfaces matching approved samples.

2.06 ACCESSORIES

- A. General: Accessories recommended by cast polymer manufacturer for complete installation.
- B. Adhesives: Type recommended by cast polymer manufacturer for application; not containing formaldehyde or volatile organic compounds.
- C. Joint Sealants: Type recommended by cast polymer manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify substrates are prepared to receive cast polymer fabrications.

3.02 PREPARATION

- A. Prepare substrates in accordance with manufacturer's written instructions.

3.03 INSTALLATION

- A. Install cast polymer units in accordance with manufacturer's written instructions.

3.04 TOLERANCES

- A. Maximum Variation from True Position: 1/4 inch (6.4 mm).
- B. Maximum Variation from Plumb: 1/4 inch in 10 feet (2 mm in 1 m).
- C. Maximum Variation from Level: 1/4 inch in 10 feet (2 mm in 1 m).

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3.05 PROTECTION

- A. Protect installed cast polymer units from subsequent construction operations.

END OF SECTION

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SECTION 078100 APPLIED FIRE PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Applied fire protection of interior structural steel not exposed to damage or moisture. Specification section included in order to provide information for possible patching of existing applied fire protection.

1.02 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.

1.03 REFERENCE STANDARDS

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

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittals procedures.
- B. Product Data: Provide data indicating product characteristics.
- C. Manufacturer's Installation Instructions: Indicate special procedures.

1.05 QUALITY ASSURANCE

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

1.06 FIELD CONDITIONS

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

1.07 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a two year period after Date of Substantial Completion.
 - 1. Include coverage for fireproofing to remain free from cracking, checking, dusting, flaking, spalling, separation, and blistering.
 - 2. Reinstall or repair failures that occur within warranty period.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Applied Fire Protection:
 - 1. GCP Applied Technologies: www.gcpat.com/#sle.
 - 2. Isolotek International Corp: www.isolotek.com/#sle.
 - 3. Southwest Fireproofing Products Company: www.sfrm.com/#sle.

2.02 APPLIED FIRE PROTECTION ASSEMBLIES

- A. Provide fire resistance ratings for following building elements as required by local building code:
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1. Floor construction, including supporting beams and joists, 2 hours.

2.03 MATERIALS

- A. Applied Fire Protection Material for Interior Applications, Concealed: Manufacturer's standard factory mixed material, which when combined with water is capable of providing indicated fire resistance, and complying with following requirements:
 1. Bond Strength: 150 pounds per square foot (7.2 kPa), minimum, when tested in accordance with ASTM E736/E736M when set and dry.
 2. Compressive Strength: 8.33 pounds per square inch (57.4 kPa), minimum.
 3. Effect of Impact on Bonding: No cracking, spalling or delamination, when tested in accordance with ASTM E760/E760M.
 4. Corrosivity: No evidence of corrosion, when tested in accordance with ASTM E937/E937M.
 5. Surface Burning Characteristics: Maximum flame spread index of 0 (zero) and maximum smoke developed index of 0 (zero), when tested in accordance with ASTM E84.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

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

3.03 APPLICATION

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

3.04 CLEANING

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

END OF SECTION

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SECTION 078400 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.

1.02 RELATED REQUIREMENTS

- A. Section 078100 - Applied Fire Protection.
- B. Section 092116 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.
- C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015 (Reapproved 2019).
- D. ITS (DIR) - Directory of Listed Products; Current Edition.
- E. FM (AG) - FM Approval Guide; Current Edition.
- F. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).
- G. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.
- H. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.
- I. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- C. Sustainable Design Submittal: Submit VOC content documentation for nonpreformed materials.

1.05 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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Firestopping Manufacturers:
 - 1. 3M Fire Protection Products: www.3m.com/firestop/#sle.
 - 2. Hilti, Inc: www.us.hilti.com/#sle.
 - 3. Specified Technologies Inc: www.stifirestop.com/#sle.
 - 4. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
 - 5. Substitutions: See Section 016000 - Product Requirements.

2.02 MATERIALS

- A. Firestopping Materials: Any materials meeting requirements.
- B. Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.
- C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

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2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. 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.
- B. 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.

2.04 FIRESTOPPING SYSTEMS

- A. Firestopping: 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 EXAMINATION

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

3.02 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.

3.03 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.

3.04 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION

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

END OF SECTION

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SECTION 079200 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 092116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
- B. Section 093000 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

1.03 REFERENCE STANDARDS

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015 (Reapproved 2022).
- B. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).
- C. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).
- D. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2022.
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- F. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2023.
- G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).
- H. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.
- I. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2022.
- J. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2023.
- K. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).
- L. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

1.04 SUBMITTALS

- A. See Section 013000 - 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.
 - 5. Substrates for which use of primer is required.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- E. Installation Plan: Submit at least four weeks prior to start of installation.
- F. Executed warranty.

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1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.
- B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of experience.
- C. Installation Plan: Include schedule of sealed joints, including the following:
 - 1. Joint width indicated in Contract Documents.
 - 2. Method to be used to protect adjacent surfaces from sealant droppings and smears, with acknowledgment that some surfaces cannot be cleaned to like-new condition and therefore prevention is imperative.

1.06 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 2-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Nonsag Sealants:
 - 1. Dow: www.dow.com/#sle.
 - 2. Henry Company: www.henry.com/#sle.
 - 3. Hilti, Inc: www.us.hilti.com/#sle.
 - 4. Sika Corporation: www.usa.sika.com/#sle.
 - 5. Substitutions: See Section 016000 - Product Requirements.
- B. Self-Leveling Sealants:
 - 1. Dow: www.dow.com/#sle.
 - 2. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
 - 3. Sika Corporation: www.usa.sika.com/#sle.
 - 4. Substitutions: See Section 016000 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

- A. Scope:
 - 1. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
 - a. Joints between door, window, and other frames and adjacent construction.
 - b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
 - c. Joints between manufactured casework, countertops, and walls.
 - d. Joints between plumbing fixtures and walls or floors.
 - e. Other joints indicated below.
 - 2. Do not seal the following types of joints:
 - a. Joints indicated to be treated with manufactured expansion joint cover, or some other type of sealing device.
 - b. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
 - c. Joints where installation of sealant is specified in another section.
 - d. Joints between suspended panel ceilings/grid and walls.
- B. Interior Joints: Use nonsag polyurethane sealant, unless otherwise indicated.
 - 1. Wall and Ceiling Joints in Non-wet Areas: Acrylic emulsion latex sealant.
 - 2. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; clear.
 - 3. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
- C. Interior Wet Areas: Bathrooms, restrooms, and kitchens; fixtures in wet areas include plumbing fixtures, countertops, cabinets, and other similar items.
- D. Sound-Rated Assemblies: Walls and ceilings identified as STC-rated, sound-rated, or acoustical.

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2.03 NONSAG JOINT SEALANTS

- A. Nonstaining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus 50 percent, minimum.
 - 2. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.
 - 3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
 - 4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
 - 5. Color: To be selected by Architect from manufacturer's full range.
 - 6. Cure Type: Single-component, neutral moisture curing.
 - 7. Service Temperature Range: Minus 65 to 180 degrees F (___ to ___ degrees C).
- B. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
 - 1. Color: Color that is specifically called out above.
- C. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus 25 percent, minimum.
 - 2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
 - 3. Color: To be selected by Architect from manufacturer's full range.
 - 4. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
- D. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, nonsagging; not intended for exterior use.
 - 1. Color: Standard colors matching finished surfaces, Type OP (opaque).
 - 2. Grade: ASTM C834; Grade 0 Degrees F (Minus 18 Degrees C).

2.04 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
 - 1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
 - 2. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- D. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- E. 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.

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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. Install acoustical sealant application work in accordance with ASTM C919.
- 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.

END OF SECTION

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SECTION 081113 HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Rated and non-rated Hollow metal frames for wood doors.
- C. Fire-rated hollow metal doors and frames.

1.02 RELATED REQUIREMENTS

- A. Section 087100 - Door Hardware.
- B. Section 088000 - Glazing: Glass for doors.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 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; 2022.
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.
- D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2020.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2021a.
- 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; 2023.
- H. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.
- I. ASTM C476 - Standard Specification for Grout for Masonry; 2023.
- J. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.
- K. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- L. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.
- M. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.
- N. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2017.
- O. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.

1.04 SUBMITTALS

- A. See Section 013000 - 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 any indicated finish requirements.

1.05 QUALITY ASSURANCE

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

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1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hollow Metal Doors and Frames:
 - 1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 2. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 3. Fleming Door Products, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 4. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
 - 5. Steelcraft, an Allegion brand: www.allegion.com/#sle.
 - 6. Substitutions: See Section 016000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
 - 1. 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.
 - 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
 - 3. Door Edge Profile: Manufacturers standard for application indicated.
 - 4. Typical Door Face Sheets: Flush.
 - 5. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. 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 door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

- A. Door Finish: Factory primed and field finished.
- B. Interior Doors, Non-Fire-Rated:
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 1 - Standard-duty.
 - b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 20 gauge, 0.032 inch (0.8 mm), minimum.
 - 2. Door Thickness: 1-3/4 inches (44.5 mm), nominal.

2.04 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: Factory primed and field finished.
- C. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
 - 1. Frame Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.
- D. Door Frames, Fire-Rated: Face welded type.
 - 1. Fire Rating: Same as door, labeled.
 - 2. Frame Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.
- E. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
- F. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.

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- G. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches (102 mm) high to fill opening without cutting masonry units.

2.05 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
- B. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15 mil, 0.015 inch (0.4 mm) dry film thickness (DFT) per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities. Provide at frames to be installed in masonry walls.
 - 1. Fire-Rated Frames: Comply with fire rating requirements indicated.

2.06 ACCESSORIES

- A. Glazing: As specified in Section 088000, factory installed.
- B. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
- C. 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.
- D. 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.
- E. 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 doors and frames in accordance with manufacturer's instructions and related requirements of specified door and 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. Install door hardware as specified in Section 087100.
- F. Coordinate installation of electrical connections to electrical hardware items.

3.04 TOLERANCES

- A. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

3.05 ADJUSTING

- A. Adjust for smooth and balanced door movement.

3.06 SCHEDULE

- A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

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SECTION 081416 FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flush wood doors; flush configuration; fire-rated and non-rated.
- B. Stile and Rail wood doors.

1.02 RELATED REQUIREMENTS

- A. Section 081213 - Hollow Metal Frames.
- B. Section 087100 - Door Hardware.
- C. Section 088000 - Glazing.

1.03 REFERENCE STANDARDS

- A. ANSI A135.4 - Basic Hardboard; 2012 (Reaffirmed 2020).
- B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
- C. ASTM E413 - Classification for Rating Sound Insulation; 2022.
- D. AWI (QCP) - Quality Certification Program; Current Edition.
- E. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- F. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2021, with Errata (2022).

1.04 SUBMITTALS

- A. See Section 013000 - 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. Include door schedule with shop drawings.
- D. Samples: Submit two samples of door veneer, 4 by 4 inches in size illustrating wood grain, stain color, and sheen.
- E. Test Reports: Show compliance with specified requirements for the following:
 - 1. Sound-retardant doors and frames; sealed panel tests are not acceptable.
- F. Manufacturer's qualification statement.
- G. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of 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 017800 - Closeout Submittals for additional warranty requirements.

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- B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- C. 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. Masonite Architectural: www.architectural.masonite.com/#sle.
 - 2. Oregon Door: www.oregondoor.com/#sle.
 - 3. VT Industries, Inc: www.vtindustries.com/#sle.
 - 4. Substitutions: See Section 016000 - 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 WDMA I.S. 1A.
 - 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) labeled without any visible seals when door is open.
 - 3. Sound-Rated Doors: Minimum STC of 35, calculated in accordance with ASTM E413, tested in accordance with ASTM E90.
 - 4. Wood veneer facing with factory transparent finish.

2.03 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and Fire Rated Doors: Type particleboard core (PC), plies and faces as indicated.
- B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.
- C. Sound-Rated Doors: Equivalent to type, with particleboard core (PC) construction as required to achieve STC rating specified; plies and faces as indicated above.

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. Intent is to match existing flush wood doors.

2.05 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
 - 1. Provide solid blocks at lock edge for hardware reinforcement.
 - 2. Provide solid blocking for other throughbolted hardware.
- C. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
- D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- F. Provide edge clearances in accordance with the quality standard specified.

2.06 FINISHES - WOOD VENEER DOORS

- A. Finish work in accordance with WDMA I.S. 1A for grade specified and as follows:
 - 1. Transparent:
 - a. System - TR-2, Catalyzed Lacquer.
 - b. Stain: To match existing doors.
 - c. Sheen: To match existing doors.

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2.07 ACCESSORIES

- A. Glazing: See Section 088000.
- B. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.

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

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SECTION 083100 ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

- A. Section 099123 - Interior Painting: Field paint finish.
- B. Section 233300 - Air Duct Accessories: Access doors in ductwork.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Shop Drawings: Indicate general position of each access door and/or panel unit.
- D. Project Record Documents: Record actual locations of each access unit.

1.05 QUALITY ASSURANCE

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

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

- A. Wall-Mounted Units:
 - 1. Location: As indicated or required.
 - 2. Panel Material: Steel.
 - 3. Size: 12 by 12 inches (305 by 305 mm) or as needed for access.
 - 4. Door/Panel: Hinged, standard duty, with cam lock and no handle.
 - 5. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.
- B. Wall-Mounted Units in Wet Areas:
 - 1. Location: In toilet rooms, foodservice areas, and other spaces with large numbers of plumbing fixtures. Locate as indicated or required.
 - 2. Panel Material: Steel, hot-dipped zinc, or zinc-aluminum-alloy coated.
 - 3. Size: 12 by 12 inches (305 by 305 mm) or as needed for access.
 - 4. Door/Panel: Hinged, standard duty, with cam lock and no handle.
 - 5. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.
- C. Fire-Rated Wall-Mounted Units:
 - 1. Location: As required for fire-rated walls.
 - 2. Wall Fire-Rating: As indicated on drawings.
 - 3. Panel Material: Steel.
 - 4. Size: 12 by 12 inches (305 by 305 mm) or as needed for access.
 - 5. Door/Panel: Insulated double-surface panel with cam lock.
- D. Ceiling-Mounted Units:
 - 1. Location: As indicated or required.
 - 2. Panel Material: Steel.
 - 3. Size - Lay-In Grid Ceilings: To match module of ceiling grid.
 - 4. Size - Other Ceilings: 12 by 12 inches (305 by 305 mm) or as needed for access.
 - 5. Door/Panel: Hinged, standard duty, with cam lock and no handle.

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2.02 WALL- AND CEILING-MOUNTED ACCESS UNITS

- A. Manufacturers:
 - 1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com/#sle.
 - 2. ACUDOR Products Inc: www.acudor.com/#sle.
 - 3. Babcock-Davis: www.babcockdavis.com/#sle.
 - 4. Best Access Doors: www.bestaccessdoors.com/#sle.
 - 5. Cendrex, Inc: www.cendrex.com/#sle.
 - 6. Elmdor: www.elmdor.com/#sle.
 - 7. FF Systems, Inc: www.ffsystemsinc.com/#sle.
 - 8. Milcor, Inc: www.milcorinc.com/#sle.
 - 9. Nystrom, Inc: www.nystrom.com/#sle.
 - 10. Substitutions: See Section 016000 - Product Requirements.
- B. Wall- and Ceiling-Mounted Units: Factory-fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
 - 1. Style: Exposed frame with door surface flush with frame surface.
 - 2. Door Style: Single thickness with rolled or turned in edges.
 - 3. Frames: 16 gauge, 0.0598 inch (1.52 mm), minimum thickness.
 - 4. Double-Skinned Hollow Steel Sheet Door Panels: 16 gauge, 0.059 inch (1.52 mm), minimum thickness, on both sides and along each edge.
 - 5. Units in Fire-Rated Assemblies: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.
 - 6. Steel Finish: Primed.
 - 7. Hardware:
 - a. Hardware for Fire-Rated Units: As required for listing.
 - b. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
 - c. Latch/Lock: Cylinder lock-operated cam latch, two keys for each unit.
 - d. Number of Locks/Latches Required: As recommended by manufacturer for size of unit.
 - e. Gasketing: Extruded neoprene, around perimeter of door panel.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings are correctly sized and located.
- B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to proceeding with this work.
- B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.03 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

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SECTION 083344 OVERHEAD COILING FIRE CURTAINS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Deployable vertical fire curtains.

1.02 RELATED REQUIREMENTS

- A. Section 211300 - Fire-Suppression Sprinkler Systems.
- B. Section 260533.13 - Conduit for Electrical Systems.
- C. Section 260583 - Wiring Connections.
- D. Section 284600 - Fire Detection and Alarm.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- B. FM (AG) - FM Approval Guide; Current Edition.
- C. ICC-ES AC77 - Acceptance Criteria for Smoke-Containment Systems Used with Fire-Resistance-Rated Elevator Hoistway Doors and Frames and at the Intersection of Elevator Lobby and Corridor; 2021.
- D. ITS (DIR) - Directory of Listed Products; Current Edition.
- E. NFPA 3 - Standard for Commissioning of Fire Protection and Life Safety Systems; 2024.
- F. NFPA 4 - Standard for Integrated Fire Protection and Life Safety System Testing; 2024.
- G. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.
- H. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2022.
- I. UL (DIR) - Online Certifications Directory; Current Edition.
- J. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- K. UL 864 - Control Units and Accessories for Fire Alarm Systems; Current Edition, Including All Revisions.
- L. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's technical literature describing product components, connections, operation details, and required electrical equipment.
- C. Shop Drawings: Submit shop drawings, including elevations, sections, details and dimensions, materials, finishes, anchorage methods, and hardware locations for specified smoke containment curtains.
- D. Manufacturer's installation instructions.
- E. Field Quality Control Submittals: Report of field testing.
- F. Maintenance contract.
- G. Operating and Maintenance Manuals: Submit complete set of manuals describing materials, devices, and procedures required to operate and maintain specified protective curtain systems.
- H. Executed warranty.

1.05 QUALITY ASSURANCE

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

1.06 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.

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- B. Manufacturer Warranty: Provide 1-year manufacturer material and labor warranty from Date of Substantial Completion. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Deployable Vertical Fire Curtains:
 - 1. Smoke Guard, Inc, a CSW Industrial Company: www.smokeguard.com/#sle.
 - 2. Substitutions: See Section 016000 - Product Requirements.

2.02 FIRE CURTAINS

- A. Fire Curtains:
 - 1. Deployable vertical curtain.
 - a. Fire Rating: 2 hours
 - b. Comply with UL 10B. Affix label to assembly.
 - c. Comply with ICC-ES AC77. Comply with and affix UL 1784 label to assembly.
 - 1) Maximum Air Leakage: 3 cfm/sq ft (0.02 cu m/sec/sq m) of door opening at 0.10 in-wc (24.9 Pa) pressure when tested in accordance with UL 1784 at both ambient and elevated temperatures.
 - d. Self-closing or automatic closing protective curtains in accordance with NFPA 80 and NFPA 105.
 - 2. Configurations: Refer to drawings and schedules for layout and additional requirements.
 - 3. Smoke and Draft Control: Self-closing or automatic closing protective curtains in accordance with NFPA 80 and NFPA 105.

2.03 COMPONENTS

- A. Coated Fabric Curtains: Woven, reinforced, and coated fabric curtain in accordance with UL 10B, with flame spread index of 25 or less and smoke developed index of 50 or less when tested in accordance with ASTM E84.
- B. Roller Assembly: Horizontal structural support with minimal deflection of protective curtain assembly, sized to incorporate motor drive unit.
- C. Side guide rails.
- D. Hood Assembly: Totally enclosed curtain and roller assembly with approved smoke seals and removable cover plates to access curtain rollers.
 - 1. Enclosure: Galvanized steel, with manufacturer's standard finish.
 - 2. Mounting: As indicated on drawings.
 - 3. Height and Depth: As indicated on drawings.
- E. Mounting Brackets: Painted metal plates and brackets as required for supporting hood assembly.
 - 1. Mounting: As indicated on drawings.
- F. Vertical Guide Assemblies: Guide rails to secure curtain during deployment and operation, with positive mechanical curtain retention.
- G. Bottom Bar: Provide seal at sill with necessary stiffness to limit deflection caused by air pressure currents.

2.04 OPERATIONAL CONTROLS

- A. Operator, Controls, Actuators, and Safeties: Provide products listed by FM (AG), ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
 - 1. Operable curtain that deploys within 10 seconds upon actuation signal from fire alarm system, local smoke detector, sprinkler alarm system, or loss of electric power to unit with listed releasing device. Comply with UL 864.
- B. Test Feature: Provide simple and easily accessible switch feature to test and confirm correct function of curtain.
- C. Fail-Safe Release Device:
 - 1. When release mechanism's power is interrupted by alarm condition, curtain automatically self-closes.
 - 2. Upon restoration of power and with cleared alarm condition, curtain release mechanism resets to open position.

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PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify blocking, installation tolerances, clearances, and other conditions needed for this work.

3.02 INSTALLATION

- A. Install system in accordance with manufacturer's written installation instructions.
- B. Install anchorage devices to securely fasten hood assembly to substrate and building framing without distortion or stress.
- C. Install conduit and wiring from disconnect to unit components. Coordinate electrical service installation; see Section 260533.13 and Section 260583.
- D. Coordinate fire suppression sprinkler system connection; see Section 211300.
- E. Coordinate fire alarm system and smoke detector connection; see Section 284600.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Provide services of manufacturer's field representative to observe installation, conduct field testing and inspection, and submit report.
- C. Provide testing and inspection for the following:
 - 1. Verify protective curtain deploys upon signal from fire alarm system or local smoke detectors.
 - 2. Verify protective curtain deploys by gravity upon damage to control panel or loss of power.

3.04 CLEANING

- A. Remove labels and visible markings from protective curtain components.

3.05 CLOSEOUT ACTIVITIES

- A. See Section 017800 - Closeout Submittals for closeout submittals.
- B. See Section 017900 - Demonstration and Training for additional requirements.

3.06 MAINTENANCE

- A. Provide separate maintenance contract for periodic inspection and performance analysis of fire curtain assemblies in accordance with NFPA 3 and NFPA 4 for one year from Date of Substantial Completion.
- B. Indicate services, obligations, conditions, and terms for agreement period and renewal options.

END OF SECTION

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SECTION 087100 DOOR HARDWARE

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Mechanical and electrified door hardware
 - 2. Electronic access control system components
- B. Section excludes:
 - 1. Windows
 - 2. Cabinets (casework), including locks in cabinets
 - 3. Signage
 - 4. Toilet accessories
 - 5. Overhead doors
- C. Related Sections:
 - 1. Division 01 "General Requirements" sections for Allowances, Alternates, Owner Furnished Contractor Installed, Project Management and Coordination.
 - 2. Division 06 Section "Rough Carpentry"
 - 3. Division 06 Section "Finish Carpentry"
 - 4. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
 - 5. Division 08 Sections:
 - a. "Metal Doors and Frames"
 - b. "Flush Wood Doors"
 - c. "Special Function Doors"
 - 6. Division 26 "Electrical" sections for connections to electrical power system and for low-voltage wiring.
 - 7. Division 28 "Electronic Safety and Security" sections for coordination with other components of electronic access control system and fire alarm system.

1.02 REFERENCES

- A. UL LLC
 - 1. UL 10B - Fire Test of Door Assemblies
 - 2. UL 10C - Positive Pressure Test of Fire Door Assemblies
 - 3. UL 1784 - Air Leakage Tests of Door Assemblies
 - 4. UL 305 - Panic Hardware
- B. DHI - Door and Hardware Institute
 - 1. Sequence and Format for the Hardware Schedule
 - 2. Recommended Locations for Builders Hardware
 - 3. Keying Systems and Nomenclature
 - 4. Installation Guide for Doors and Hardware
- C. NFPA – National Fire Protection Association
 - 1. NFPA 70 – National Electric Code
 - 2. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
 - 3. NFPA 101 – Life Safety Code
 - 4. NFPA 105 – Smoke and Draft Control Door Assemblies
 - 5. NFPA 252 – Fire Tests of Door Assemblies
- D. ANSI - American National Standards Institute
 - 1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
 - 2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
 - 3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
 - 4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
 - 5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

- A. General:
 - 1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
 - 2. Prior to forwarding submittal:

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- a. Review drawings and Sections from related trades to verify compatibility with specified hardware.
 - b. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.
- B. Action Submittals:
1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
 2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
 - a. Wiring Diagrams: For power, signal, and control wiring and including:
 - 1) Details of interface of electrified door hardware and building safety and security systems.
 - 2) Schematic diagram of systems that interface with electrified door hardware.
 - 3) Point-to-point wiring.
 - 4) Risers.
 3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.
 - a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
 4. Door Hardware Schedule:
 - a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
 - b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
 - c. Indicate complete designations of each item required for each opening, include:
 - 1) Door Index: door number, heading number, and Architect's hardware set number.
 - 2) Quantity, type, style, function, size, and finish of each hardware item.
 - 3) Name and manufacturer of each item.
 - 4) Fastenings and other pertinent information.
 - 5) Location of each hardware set cross-referenced to indications on Drawings.
 - 6) Explanation of all abbreviations, symbols, and codes contained in schedule.
 - 7) Mounting locations for hardware.
 - 8) Door and frame sizes and materials.
 - 9) Degree of door swing and handing.
 - 10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.
 5. Key Schedule:
 - a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
 - b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
 - c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
 - d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
 - e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
 - f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.
- C. Informational Submittals:
1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
 2. Provide Product Data:
 - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
 - b. Include warranties for specified door hardware.
- D. Closeout Submittals:

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1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
 - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Final approved hardware schedule edited to reflect conditions as installed.
 - d. Final keying schedule
 - e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
 - f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
- E. Inspection and Testing:
 1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:
 - a. Fire door assemblies, in compliance with NFPA 80.
 - b. Required egress door assemblies, in compliance with NFPA 101.

1.04 QUALITY ASSURANCE

- A. Qualifications and Responsibilities:
 1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
 2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
 3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
 - a. For door hardware: DHI certified AHC or DHC.
 - b. Can provide installation and technical data to Architect and other related subcontractors.
 - c. Can inspect and verify components are in working order upon completion of installation.
 - d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.
 4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
- B. Certifications:
 1. Fire-Rated Door Openings:
 - a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
 - b. Provide only items of door hardware that are listed products tested by UL LLC, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
 2. Smoke and Draft Control Door Assemblies:
 - a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
 - b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.
 3. Electrified Door Hardware
 - a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
 4. Accessibility Requirements:
 - a. Comply with governing accessibility regulations cited in "REFERENCES" article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.
- C. Pre-Installation Meetings
 1. Keying Conference

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- a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
 - 1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - 2) Preliminary key system schematic diagram.
 - 3) Requirements for key control system.
 - 4) Requirements for access control.
 - 5) Address for delivery of keys.
2. Pre-installation Conference
 - a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Inspect and discuss preparatory work performed by other trades.
 - c. Inspect and discuss electrical roughing-in for electrified door hardware.
 - d. Review sequence of operation for each type of electrified door hardware.
 - e. Review required testing, inspecting, and certifying procedures.
 - f. Review questions or concerns related to proper installation and adjustment of door hardware.
3. Electrified Hardware Coordination Conference:
 - a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.
- C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
- D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.06 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.07 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.
 1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
 2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.
 - a. Mechanical Warranty
 - 1) Locks
 - (a) Schlage L Series: 10 years
 - 2) Exit Devices

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- (a) Von Duprin: 10 years
- 3) Closers
 - (a) LCN 4000 Series: 30 years
 - (b) LCN 1460 Series: 30 years
- b. Electrical Warranty
 - 1) Locks
 - (a) Schlage: 3 years
 - 2) Exit Devices
 - (a) Von Duprin: 3 years

1.08 MAINTENANCE

- A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.
- B. Turn over unused materials to Owner for maintenance purposes.

1.09 REFERENCE STANDARDS

- A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2019.
- B. BHMA A156.1 - Standard for Butts and Hinges; 2021.
- C. BHMA A156.3 - Exit Devices; 2020.
- D. BHMA A156.4 - Door Controls - Closers; 2019.
- E. BHMA A156.13 - Mortise Locks & Latches Series 1000; 2022.
- F. BHMA A156.28 - Standard for Recommended Practices for Mechanical Keying Systems; 2023.
- G. BHMA A156.31 - Electric Strikes and Frame Mounted Actuators; 2019.
- H. ISO 9000 - Quality Management Systems -- Fundamentals and Vocabulary; 2015.
- 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; 2022.
- 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; 2022.
- M. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.
- N. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- O. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- P. UL 305 - Standard for Panic Hardware; Current Edition, Including All Revisions.
- Q. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.
- R. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2021, with Errata (2022).

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. The Owner requires use of certain products for their unique characteristics and project suitability to ensure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: "No Substitute."
 - 1. Where "No Substitute" is noted, submittals and substitution requests for other products will not be considered.
- B. Approval of alternate manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category are only to be considered by official substitution request in accordance with section 01 25 00.
- C. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled

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manufacturer's product.

- D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fabrication

1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer's recognized installation standards for application intended.
2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with "Metal Doors and Frames", "Flush Wood Doors", "Stile and Rail Wood Doors" to ensure proper reinforcements. Advise the Architect where visible fasteners, such as thru bolts, are required.

B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

C. Cable and Connectors:

1. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with number and gage of wires enough to accommodate electric function of specified hardware.
2. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices.
3. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.03 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Ives 3CB series
2. Acceptable Manufacturers and Products:
 - a. Per Architect/Owner's approval

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Provide 3 knuckle, concealed bearing hinges.
3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
 - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
 - b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
4. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
 - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
5. 2 inches or thicker doors:
 - a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
6. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
7. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
8. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - a. Steel Hinges: Steel pins
 - b. Non-Ferrous Hinges: Stainless steel pins
 - c. Out-Swinging Exterior Doors: Non-removable pins
 - d. Out-Swinging Interior Lockable Doors: Non-removable pins
 - e. Interior Non-lockable Doors: Non-rising pins
9. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
10. Provide hinges with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electric hinge

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at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.

2.04 SPRING HINGES

- A. Manufacturers and Products:
 - 1. Scheduled Manufacturer and Product:
 - a. Ives 3SP series
 - 2. Acceptable Manufacturers and Products:
 - a. Per Architect/Owner's approval
- B. Requirements:
 - 1. Provide hinges conforming to ANSI/BHMA A156.1.
 - 2. Provide 3 knuckle, steel based, spring full mortise hinges.
 - 3. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
 - 4. Provide two spring hinges and one bearing hinge per door leaf for doors 90 inches (2286 mm) or less in height. Do not use spring hinges of door 96 inches and greater in height.

2.05 ELECTRIC POWER TRANSFER

- A. Manufacturers:
 - 1. Scheduled Manufacturer and Product:
 - a. Von Duprin EPT-10
 - 2. Acceptable Manufacturers and Products:
 - a. Per Architect/Owner's approval
- B. Requirements:
 - 1. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
 - 2. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

2.06 MORTISE LOCKS

- A. Manufacturers and Products:
 - 1. Scheduled Manufacturer and Product:
 - a. Schlage L9000 series
 - 2. Acceptable Manufacturers and Products:
 - a. Per Architect/Owner's approval
- B. Requirements:
 - 1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3-hour fire doors.
 - 2. Indicators: Where specified, provide indicator window measuring a minimum 2-3/5-inch x 3/5 inch with 180-degree visibility. Provide messages color-coded using ANSI Z535 Safety Red with full text and/or symbols, as scheduled, for easy visibility. When applicable allows for lock status indication on both sides of the door.
 - 3. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
 - 4. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
 - 5. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1-inch (25 mm) throw, constructed of stainless steel.
 - 6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide switches and sensors integrated into the locks and latches.
 - 7. Provide motor based electrified locksets that comply with the following requirements:
 - a. Universal input voltage – single chassis accepts 12 or 24VDC to allow for changes in the field without changing lock chassis.
 - b. Fail Safe/Fail Secure – changing mode between electrically locked (fail safe) and electrically unlocked (fail secure) is field selectable without opening the lock case.
 - c. Low maximum current draw – maximum 0.4 amps to allow for multiple locks on a single power supply.
 - d. Low holding current – maximum 0.01 amps to produce minimal heat, eliminate "hot levers" in electrically locked applications, and to provide reliable operation in wood doors that provide minimal ventilation and air flow.

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- e. Connections – provide quick-connect Molex system standard.
- 8. (KEY OVERRIDE OPTION WHEN XL13-439 IS SPECIFIED IN HARDWARE SETS) Provide locks with a key override feature built into the chassis that allows the outside key to retract the deadbolt and/or latchbolt, overriding the inside thumbturn when it is being held in the locked position.
- 9. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
 - a. Lever Design: Schlage 03A.

2.07 EXIT DEVICES

- A. Manufacturers and Products:
 - 1. Scheduled Manufacturer and Product:
 - a. Von Duprin 99 series
 - 2. Acceptable Manufacturers and Products:
 - a. Per Architect/Owner's approval
- B. Requirements:
 - 1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
 - 2. Cylinders: Refer to "KEYING" article, herein.
 - 3. Provide grooved touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
 - 4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
 - 5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
 - 6. Provide exit devices with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.
 - 7. Provide flush end caps for exit devices.
 - 8. Provide exit devices with manufacturer's approved strikes.
 - 9. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
 - 10. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
 - 11. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
 - 12. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
 - 13. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
 - 14. Provide electrified options as scheduled.
 - 15. Top latch mounting: double- or single-tab mount for steel doors, face mount for aluminum doors eliminating requirement of tabs, and double tab mount for wood doors.
 - 16. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.

2.08 ELECTRIC STRIKES

- A. Manufacturers and Products:
 - 1. Scheduled Manufacturer and Product:
 - a. Von Duprin 6000 Series
 - 2. Acceptable Manufacturers and Products:
 - a. Per Architect/Owner's approval
- B. Requirements:
 - 1. Provide electric strikes designed for use with type of locks shown at each opening.
 - 2. Provide electric strikes UL Listed as burglary resistant that are tested to a minimum endurance test of 1,000,000 cycles.
 - 3. Where required, provide electric strikes UL Listed for fire doors and frames.
 - 4. Provide transformers and rectifiers for each strike as required. Verify voltage with electrical contractor.

2.09 CYLINDERS

- A. Manufacturers and Products:
 - 1. Scheduled Manufacturer and Product:

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- a. Schlage Everest 29 With keyway matching existing
2. Acceptable Manufacturers and Products:
 - a. No Substitute
- B. Requirements:
 1. Provide cylinders/cores compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset; manufacturer's series as indicated. Refer to "KEYING" article, herein.
 2. Provide cylinders in the below-listed configuration(s), distributed throughout the Project as indicated.
 - a. Patented Restricted: cylinder with interchangeable core with patented, restricted keyway.
 3. Patent Protection: Cylinders/cores requiring use of restricted, patented keys, patent protected.
 4. Nickel silver bottom pins.

2.10 KEYING

- A. Scheduled System:
 1. Existing factory registered system:
 - a. Provide cylinders/cores keyed into Owner's existing factory registered keying system. Comply with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
- B. Requirements:
 1. Construction Keying:
 - a. Replaceable Construction Cores.
 - 1) Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
 - (a) 3 construction control keys
 - (b) 12 construction change (day) keys.
 - 2) Owner or Owner's Representative will replace temporary construction cores with permanent cores.
 2. Permanent Keying:
 - a. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
 - 1) Master Keying system as directed by the Owner.
 - b. Forward biting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
 - c. Provide keys with the following features:
 - 1) Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
 - 2) Patent Protection: Keys and blanks protected by one or more utility patent(s).
 - 3) Geographically Exclusive: Where High Security or Security cylinders/cores are indicated, provide nationwide, geographically exclusive key system complying with the following restrictions.
 - d. Identification:
 - 1) Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
 - 2) Identification stamping provisions must be approved by the Architect and Owner.
 - 3) Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
 - 4) Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
 - 5) Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
 - e. Quantity: Furnish in the following quantities.
 - 1) Permanent Control Keys: 3.
 - 2) Master Keys: 6.
 - 3) Change (Day) Keys: 3 per cylinder/core that is keyed differently
 - 4) Key Blanks: Quantity as determined in the keying meeting.

2.11 KEY CONTROL SYSTEM

- A. Manufacturers:
 1. Scheduled Manufacturer:
 - a. Per Owner's request

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2.12 DOOR CLOSERS

- A. Manufacturers and Products:
 - 1. Scheduled Manufacturer and Product:
 - a. LCN 4010/4110/4020 series
 - 2. Acceptable Manufacturers and Products:
 - a. Per Architect/Owner's approval
- B. Requirements:
 - 1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. Certify surface mounted mechanical closers to meet fifteen million (15,000,000) full load cycles. ISO 9000 certify closers. Stamp units with date of manufacture code.
 - 2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
 - 3. Cylinder Body: 1-1/2-inch (38 mm) diameter with 11/16-inch (17 mm) diameter double heat-treated pinion journal.
 - 4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
 - 5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
 - 6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
 - 7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers. When closers are parallel arm mounted, provide closers which mount within 6-inch (152 mm) top rail without use of mounting plate so that closer is not visible through vision panel from pull side.
 - 8. Pressure Relief Valve (PRV) Technology: Not permitted.
 - 9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI/BHMA Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
 - 10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.13 DOOR CLOSERS

- A. Manufacturers and Products:
 - 1. Scheduled Manufacturer and Product:
 - a. LCN 1460 series
 - 2. Acceptable Manufacturers and Products:
 - a. Per Architect/Owner's approval
- B. Requirements:
 - 1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory.
 - 2. Provide door closers with fully hydraulic, full rack and pinion action cast iron cylinder.
 - 3. Closer Body: 1-1/4-inch (32 mm) diameter, with 5/8-inch (16 mm) diameter heat-treated pinion journal.
 - 4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
 - 5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
 - 6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
 - 7. Pressure Relief Valve (PRV) Technology: Not permitted.
 - 8. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.14 CONCEALED DOOR CLOSERS

- A. Manufacturers and Products:
 - 1. Scheduled Manufacturer and Product:
 - a. LCN 2010 series
 - 2. Acceptable Manufacturers and Products:
 - a. Per Architect/Owner's approval

- B. Requirements:

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1. Provide concealed door closers at doors conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Provide heavy duty, single-acting closers with single lever arm and roller assembly
4. Cylinder Body: 1-1/2-inch (38 mm) diameter with 11/16-inch (17 mm) diameter double heat-treated pinion journal.
5. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
6. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
7. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI/BHMA Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, and adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.15 DOOR TRIM

- A. Manufacturers:
 1. Scheduled Manufacturer:
 - a. Ives
 2. Acceptable Manufacturers:
 - a. Trimco
 - b. Rockwood
- B. Requirements:
 1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

2.16 PROTECTION PLATES

- A. Manufacturers:
 1. Scheduled Manufacturer:
 - a. Ives
 2. Acceptable Manufacturers:
 - a. Trimco
 - b. Rockwood
- B. Requirements:
 1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
 2. Sizes plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.
 3. At fire rated doors, provide protection plates over 16 inches high with UL label.

2.17 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

- A. Manufacturers:
 1. Scheduled Manufacturers:
 - a. Glynn-Johnson
 2. Acceptable Manufacturers:
 - a. Per Architect/Owner's approval
- B. Requirements:
 1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.

2.18 DOOR STOPS AND HOLDERS

- A. Manufacturers:
 1. Scheduled Manufacturer:
 - a. Ives

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2. Acceptable Manufacturers:
 - a. Trimco
 - b. Rockwood
- B. Provide door stops at each door leaf:
 1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
 2. Where a wall stop cannot be used, provide universal floor stops.
 3. Where wall or floor stop cannot be used, provide overhead stop.
 4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.19 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

- A. Manufacturers:
 1. Scheduled Manufacturer:
 - a. Zero International
 2. Acceptable Manufacturers:
 - a. National Guard
 - b. Pemko
- B. Requirements:
 1. Provide thresholds, weather-stripping, and gasketing systems as specified and per architectural details. Match finish of other items.
 2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
 4. Size thresholds 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

2.20 SILENCERS

- A. Manufacturers:
 1. Scheduled Manufacturer:
 - a. Ives
 2. Acceptable Manufacturers:
 - a. Rockwood
 - b. Trimco
- B. Requirements:
 1. Provide "push-in" type silencers for hollow metal or wood frames.
 2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
 3. Omit where gasketing is specified.

2.21 FINISHES

- A. FINISH: BHMA 625/651 (US26); EXCEPT:
 1. Locksets: BHMA 629 (US32)
 2. Push Plates, Pulls, and Push Bars: BHMA 629 (US32)
 3. Protection Plates: BHMA 629 (US32)
 4. Overhead Stops and Holders: BHMA 629 (US32)
 5. Door Closers: BHMA 689
 6. Weatherstripping: Clear Anodized Aluminum
 7. Thresholds: Mill Finish Aluminum

PART 3 EXECUTION

3.01 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

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- C. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
 - 4. Installation Guide for Doors and Hardware: DHI TDH-007-20
- B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.
- C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.
- I. Lock Cylinders:
 - 1. Install construction cores to secure building and areas during construction period.
 - 2. Replace construction cores with permanent cores as indicated in keying section.
 - 3. Furnish permanent cores to Owner for installation.
- J. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:
 - 1. Conduit, junction boxes and wire pulls.
 - 2. Connections to and from power supplies to electrified hardware.
 - 3. Connections to fire/smoke alarm system and smoke evacuation system.
 - 4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
 - 5. Connections to panel interface modules, controllers, and gateways.
 - 6. Testing and labeling wires with Architect's opening number.
- K. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- L. Continuous Hinges: Re-locate the door and frame fire rating labels where they will remain visible so that the hinge does not cover the label once installed.
- M. Door Closers & Auto Operators: Mount closers/operators on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers/operators so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.
- N. Overhead Stops/Holders: Mount overhead stops/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- O. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.
- P. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- Q. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- R. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- S. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

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T. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.03 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Spring Hinges: Adjust to achieve positive latching when door can close freely from an open position of 30 degrees.
 - 2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 - 3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.04 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items per manufacturer's instructions to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.05 DOOR HARDWARE SCHEDULE

- A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.
- B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.
- C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.
- D. Hardware Sets:

LEGEND:

LINK TO CATALOG CUT SHEET

~ELECTRIFIED OPENING

HARDWARE GROUP NO. 01

FOR USE ON DOOR #(S):

2034C					
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PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	3CB1HW 4.5 X 4.5 NRP	<input type="checkbox"/>		651	IVE
1	EA	POWER TRANSFER	EPT10 CON	<input type="checkbox"/>	~	689	VON
1	EA	DELAYED FIRE EXIT HARDWARE	CX99-L-F- M996-03- FS-CON-	<input type="checkbox"/>	~	625	VON

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			SNB 24 VDC				
1	EA	RIM CYLINDER	20-057 ICX	<input type="checkbox"/>		625	SCH
1	EA	MORTISE CYLINDER	20-061 ICX (CAM & RING AS REQ'D) FOR CHEXIT)	<input type="checkbox"/>		626	SCH
2	EA	PERMANENT FSIC CORE	23-030	<input type="checkbox"/>		626	SCH
1	EA	SURFACE CLOSER	4111 SCUSH TBSRT 1 3/4"	<input type="checkbox"/>		689	LCN
1	EA	GASKETING	488SBK PSA @ HEAD & JAMBS	<input type="checkbox"/>		BK	ZER
1	EA	DOOR BOTTOM	364AA-Z49	<input type="checkbox"/>		AA	ZER
1	EA	VIEWER	U698	<input type="checkbox"/>		625	IVE
1	EA	WIRE HARNESS (FROM DEVICE TO HINGE)	CON-XXXP (LENGTH TO SUIT) VERIFY LENGTH		~		SCH
1	EA	POWER SUPPLY WIRE HARNESS	CON-6W		~		SCH
2	EA	CREDENTIAL READER	BY DIVISION 28.		~		
1	EA	LOW VOLTAGE POWER	BY LOW VOLTAGE		~		

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OPERATION:

DOOR IS NORMALLY LATCHED AND SECURED
 PRESENTING VALID CREDENTIAL FROM PULL SIDE TEMPORARILY DISARMS THE ALARM AND
 ALLOWS LEVER TO RETRACT LATCHBOLT FOR ENTRY
 PRESENTING VALID CREDENTIAL FROM PUSH SIDE TEMPORARILY DISABLES DELAYED
 EGRESS DEVICE FOR IMMEDIATE EXIT
 PUSHING ACTUATOR BAR WITHOUT PRESENTING VALID CREDENTIAL SOUNDS ALARM AND
 LATCHBOLT IS RETRACTED FOR EXIT IN 15 SECONDS; MANUALLY RESET ALARM
 DOOR IS FOR IMMEDIATE EXIT OR ENTRY UPON ACTIVATION OF FIRE ALARM SYSTEM, OR
 LOSS OF POWER TO THE DEVICE

HARDWARE GROUP NO. 02

FOR USE ON DOOR #(S):

2034A					
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PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
8	EA	HINGE	3CB1HW 4.5 X 4.5	<input type="checkbox"/>	651	IVE
1	EA	FIRE EXIT HARDWARE	9927-L-F-LBR-03-499F	<input type="checkbox"/>	625	VON
1	EA	FIRE EXIT HARDWARE	9927-L-F-LBRAFL-03-499F	<input type="checkbox"/>	625	VON
2	EA	RIM CYLINDER	20-057 ICX	<input type="checkbox"/>	625	SCH
2	EA	PERMANENT FSIC CORE	23-030	<input type="checkbox"/>	626	SCH
2	EA	CONCEALED CLOSER	2011 WMS	<input type="checkbox"/>	689	LCN
2	EA	WALL STOP	WS404	<input type="checkbox"/>	625	IVE
1	EA	GASKETING	488SBK PSA @ HEAD & JAMBS	<input type="checkbox"/>	BK	ZER
2	EA	DOOR BOTTOM	364AA-Z49	<input type="checkbox"/>	AA	ZER

HARDWARE GROUP NO. 03

FOR USE ON DOOR #(S):

2040					
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PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
4	EA	HINGE	3CB1 4.5 X 4.5	<input type="checkbox"/>	651	IVE
1	EA	STOREROOM LOCK	L9080T 03A	<input type="checkbox"/>	629	SCH
1	EA	PERMANENT FSIC CORE	23-030	<input type="checkbox"/>	626	SCH
1	EA	WALL STOP	WS404	<input type="checkbox"/>	625	IVE
3	EA	SILENCER	SR64	<input type="checkbox"/>	GRY	IVE

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HARDWARE GROUP NO. 04

FOR USE ON DOOR #(S):

2023					
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PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	3CB1HW 4.5 X 4.5	<input type="checkbox"/>		651	IVE
1	EA	STOREROOM LOCK	L9080T 03A	<input type="checkbox"/>		629	SCH
1	EA	PERMANENT FSIC CORE	23-030	<input type="checkbox"/>		626	SCH
1	EA	ELECTRIC STRIKE	6213 FSE 12/16/24/28 VAC/VDC	<input type="checkbox"/>	~	629	VON
1	EA	SURFACE CLOSER	1461 STD	<input type="checkbox"/>		689	LCN
1	EA	WALL STOP	WS404	<input type="checkbox"/>		625	IVE
3	EA	SILENCER	SR64	<input type="checkbox"/>		GRY	IVE
1	EA	CREDENTIAL READER	BY DIVISION 28.		~		
1	EA	LOW VOLTAGE POWER	BY LOW VOLTAGE		~		

FIELD VERIFY EXISTING DOOR, FRAME AND HARDWARE CONDITIONS, AND PROVIDE HARDWARE AS NECESSARY
 PROVIDE HARDWARE FOR 180-DEGREE DOOR SWING

OPERATION:

DOOR IS NORMALLY LATCHED AND SECURED
 PRESENTING VALID CREDENTIAL TEMPORARILY RELEASES STRIKE FOR ENTRY
 DOOR IS SECURED UPON LOSS OF POWER TO THE STRIKE
 FREE EGRESS AT ALL TIMES

HARDWARE GROUP NO. 04A

FOR USE ON DOOR #(S):

2058	2064				
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PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	3CB1HW 4.5 X 4.5 NRP	<input type="checkbox"/>		651	IVE
1	EA	POWER TRANSFER	EPT10 CON	<input type="checkbox"/>	~	689	VON
1	EA	DELAYED PANIC HARDWARE	CX99-L-M996-03-FS-CON 24	<input type="checkbox"/>	~	625	VON

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			VDC				
1	EA	RIM CYLINDER	20-057 ICX	<input type="checkbox"/>		625	SCH
1	EA	MORTISE CYLINDER	20-061 ICX (CAM & RING AS REQ'D)	<input type="checkbox"/>		626	SCH
2	EA	PERMANENT FSIC CORE	23-030	<input type="checkbox"/>		626	SCH
1	EA	SURFACE CLOSER	1461 EDA STD	<input type="checkbox"/>		689	LCN
1	EA	WALL STOP	WS404	<input type="checkbox"/>		625	IVE
1	EA	GASKETING	488SBK PSA @ HEAD & JAMBS	<input type="checkbox"/>		BK	ZER
1	EA	WIRE HARNESS (FROM DEVICE TO HINGE)	CON-XXXP (LENGTH TO SUIT) VERIFY LENGTH		~		SCH
1	EA	POWER SUPPLY WIRE HARNESS	CON-6W		~		SCH
2	EA	CREDENTIAL READER	BY DIVISION 28.		~		
1	EA	LOW VOLTAGE POWER	BY LOW VOLTAGE		~		

**CONNECT FAIL SAFE TRIM AND DELAYED EGRESS DEVICE TO FIRE ALARM SYSTEM
FIELD VERIFY EXISTING DOOR, FRAME AND HARDWARE CONDITIONS, AND PROVIDE
HARDWARE AS NECESSARY FOR DOOR #2064**

OPERATION:

**DOOR IS NORMALLY LATCHED AND SECURED
PRESENTING VALID CREDENTIAL FROM PULL SIDE TEMPORARILY DISARMS THE ALARM AND
ALLOWS LEVER TO RETRACT LATCHBOLT FOR ENTRY
PRESENTING VALID CREDENTIAL FROM PUSH SIDE TEMPORARILY DISABLES DELAYED
EGRESS DEVICE FOR IMMEDIATE EXIT
PUSHING ACTUATOR BAR WITHOUT PRESENTING VALID CREDENTIAL SOUNDS ALARM AND
LATCHBOLT IS RETRACTED FOR EXIT IN 15 SECONDS; MANUALLY RESETS ALARM
DOOR IS FOR IMMEDIATE EGRESS UPON ACTIVATION OF FIRE ALARM SYSTEM, OR LOSS OF
POWER TO THE DEVICE**

HARDWARE GROUP NO. 05

FOR USE ON DOOR #(S):

2031A					
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PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY	DESCRIPTION CATALOG	FINISH	MFR
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3	EA	HINGE	NUMBER 3CB1HW 4.5 X 4.5	<input type="checkbox"/>		651	IVE
1	EA	STOREROOM LOCK	L9080T 03A	<input type="checkbox"/>		629	SCH
1	EA	PERMANENT FSIC CORE	23-030	<input type="checkbox"/>		626	SCH
1	EA	ELECTRIC STRIKE	6213 FSE 12/16/24/28 VAC/VDC	<input type="checkbox"/>	~	629	VON
1	EA	SURFACE CLOSER	1461 STD	<input type="checkbox"/>		689	LCN
1	EA	WALL STOP	WS404	<input type="checkbox"/>		625	IVE
1	EA	GASKETING	488SBK PSA @ HEAD & JAMBS	<input type="checkbox"/>		BK	ZER
1	EA	DOOR BOTTOM	364AA-Z49	<input type="checkbox"/>		AA	ZER

OPERATION:

DOOR IS NORMALLY LATCHED AND SECURED
PRESENTING VALID CREDENTIAL TEMPORARILY RELEASES STRIKE FOR ENTRY
DOOR IS SECURED UPON LOSS OF POWER TO THE STRIKE
FREE EGRESS AT ALL TIMES

HARDWARE GROUP NO. 06

FOR USE ON DOOR #(S):

2028	2029				
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PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	3CB1HW 4.5 X 4.5	<input type="checkbox"/>		651	IVE
1	EA	CLASSROOM LOCK	L9070T 03A	<input type="checkbox"/>		629	SCH
1	EA	PERMANENT FSIC CORE	23-030	<input type="checkbox"/>		626	SCH
1	EA	SURFACE CLOSER	1461 STD TBSRT 1 3/4"	<input type="checkbox"/>		689	LCN
1	EA	WALL STOP	WS404	<input type="checkbox"/>		625	IVE
1	EA	GASKETING	488SBK PSA @ HEAD & JAMBS	<input type="checkbox"/>		BK	ZER
1	EA	DOOR BOTTOM	364AA-Z49	<input type="checkbox"/>		AA	ZER

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HARDWARE GROUP NO. 07

FOR USE ON DOOR #(S):

2032	2033				
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PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1HW 4.5 X 4.5	<input type="checkbox"/>	651	IVE
1	EA	STOREROOM LOCK	L9080T 03A	<input type="checkbox"/>	629	SCH
1	EA	PERMANENT FSIC CORE	23-030	<input type="checkbox"/>	626	SCH
1	EA	SURFACE CLOSER	1461 SCUSH STD TBSRT 1 3/4"	<input type="checkbox"/>	689	LCN
1	EA	GASKETING	488SBK PSA @ HEAD & JAMBS	<input type="checkbox"/>	BK	ZER

HARDWARE GROUP NO. 08

FOR USE ON DOOR #(S):

2039					
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PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
4	EA	HINGE	3CB1HW 4.5 X 4.5	<input type="checkbox"/>	651	IVE
1	EA	CLASSROOM LOCK W/ OUTSIDE INDICATOR	L9070T 03A OS-OCC	<input type="checkbox"/>	629	SCH
2	EA	PERMANENT FSIC CORE	23-030	<input type="checkbox"/>	626	SCH
1	EA	SURFACE CLOSER	4010 STD TBSRT 1 3/4"	<input type="checkbox"/>	689	LCN
1	EA	WALL STOP	WS404	<input type="checkbox"/>	625	IVE
1	EA	GASKETING	488SBK PSA @ HEAD & JAMBS	<input type="checkbox"/>	BK	ZER
1	EA	DOOR BOTTOM	364AA-Z49	<input type="checkbox"/>	AA	ZER

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VERIFY LOCK FUNCTION. DOUBLE CYLINDER LOCK IS SPECIFIED

HARDWARE GROUP NO. 09

FOR USE ON DOOR #(S):

2031B

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1 4.5 X 4.5	<input type="checkbox"/>	651	IVE
1	EA	CLASSROOM LOCK	L9070T 03A	<input type="checkbox"/>	629	SCH
1	EA	PERMANENT FSIC CORE	23-030	<input type="checkbox"/>	626	SCH
1	EA	OH STOP	90S	<input type="checkbox"/>	629	GLY
1	EA	GASKETING	488SBK PSA @ HEAD & JAMBS	<input type="checkbox"/>	BK	ZER
1	EA	DOOR BOTTOM	364AA-Z49	<input type="checkbox"/>	AA	ZER

HARDWARE GROUP NO. 10

FOR USE ON DOOR #(S):

2030

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1 4.5 X 4.5	<input type="checkbox"/>	651	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR W/ INSIDE INDICATOR	L9040 03A 09-544 OS- OCC IS- LOC	<input type="checkbox"/>	629	SCH
1	EA	SURFACE CLOSER	1461 STD	<input type="checkbox"/>	689	LCN
1	EA	WALL STOP	WS404	<input type="checkbox"/>	625	IVE
1	EA	GASKETING	488SBK PSA @ HEAD & JAMBS	<input type="checkbox"/>	BK	ZER

HARDWARE GROUP NO. 11

FOR USE ON DOOR #(S):

2034B

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PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
8	EA	HINGE	3CB1HW 4.5 X 4.5	<input type="checkbox"/>		651	IVE
2	EA	DOOR PULL	163-12" CTC (QU)			629	
2	EA	CONCEALED CLOSER	2011 WMS	<input type="checkbox"/>		689	LCN
2	EA	KICK PLATE/PUSH PLATE	8400 4" X 16" B-NH-A	<input type="checkbox"/>		629	IVE
2	EA	WALL STOP	WS404	<input type="checkbox"/>		625	IVE
1	EA	GASKETING	488SBK PSA @ HEAD & JAMBS	<input type="checkbox"/>		BK	ZER
2	EA	DOOR BOTTOM	364AA-Z49	<input type="checkbox"/>		AA	ZER

HARDWARE GROUP NO. 12

FOR USE ON DOOR #(S):

2035					
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PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	3CB1HW 4.5 X 4.5 NRP	<input type="checkbox"/>		651	IVE
1	EA	DBL CYL APT ENTRANCE	L9060T 03A	<input type="checkbox"/>		629	SCH
2	EA	PERMANENT FSIC CORE	23-030	<input type="checkbox"/>		626	SCH
1	EA	SURFACE CLOSER	4111 EDA TBSRT 1 3/4"	<input type="checkbox"/>		689	LCN
1	EA	WALL STOP	WS404	<input type="checkbox"/>		625	IVE
1	EA	GASKETING	488SBK PSA @ HEAD & JAMBS	<input type="checkbox"/>		BK	ZER
1	EA	DOOR BOTTOM	364AA-Z49	<input type="checkbox"/>		AA	ZER

HARDWARE GROUP NO. 13

FOR USE ON DOOR #(S):

2010	2011	2013	2014	2015	2016
2017	2018	2019	2020	2021	

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PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	3CB1 4.5 X 4.5	<input type="checkbox"/>		651	IVE
1	EA	OFFICE/ENTRY LOCK	L9050T 03A 09-544	<input type="checkbox"/>		629	SCH
1	EA	PERMANENT FSIC CORE	23-030	<input type="checkbox"/>		626	SCH
1	EA	SURFACE CLOSER	1460T STD TBSRT 1 3/4"	<input type="checkbox"/>		689	LCN
1	EA	WALL STOP	WS404	<input type="checkbox"/>		625	IVE
1	EA	GASKETING	488SBK PSA @ HEAD & JAMBS	<input type="checkbox"/>		BK	ZER

HARDWARE GROUP NO. 14

FOR USE ON DOOR #(S):

2022							
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PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	3CB1HW 4.5 X 4.5	<input type="checkbox"/>		651	IVE
1	EA	PANIC HARDWARE W/PASSAGE TRIM	99-L-BE-03	<input type="checkbox"/>		625	VON
1	EA	SURFACE CLOSER	4111 HEDA TBSRT 1 3/4"	<input type="checkbox"/>		689	LCN
1	EA	WALL STOP	WS404	<input type="checkbox"/>		625	IVE
3	EA	SILENCER	SR64	<input type="checkbox"/>		GRY	IVE

DOOR MAY BE HELD OPEN WITH CLOSER ARM

HARDWARE GROUP NO. 16

FOR USE ON DOOR #(S):

2007A							
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PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	3CB1HW 4.5 X 4.5 NRP	<input type="checkbox"/>		651	IVE
1	EA	PANIC	99-L-NL-03	<input type="checkbox"/>		625	VON

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		HARDWARE					
1	EA	RIM CYLINDER	20-057 ICX	<input type="checkbox"/>		625	SCH
1	EA	PERMANENT FSIC CORE	23-030	<input type="checkbox"/>		626	SCH
1	EA	ELECTRIC STRIKE	6111 FSE 12/24 VAC/VDC	<input type="checkbox"/>	~	629	VON
1	EA	SURFACE CLOSER	4111 SCUSH TBSRT 1 3/4"	<input type="checkbox"/>		689	LCN
1	EA	GASKETING	488SBK PSA @ HEAD & JAMBS	<input type="checkbox"/>		BK	ZER
1	EA	DOOR BOTTOM	364AA-Z49	<input type="checkbox"/>		AA	ZER
1	EA	CREDENTIAL READER	BY DIVISION 28.		~		
1	EA	REMOTE RELEASE BUTTON	BY DIVISION 28.		~		
1	EA	LOW VOLTAGE POWER	BY LOW VOLTAGE		~		

OPERATION:

DOOR IS NORMALLY LATCHED AND SECURED
 PRESENTING VALID CREDENTIAL OR PUSHING REMOTE RELEASE BUTTON TEMPORARILY
 RELEASES STRIKE FOR ENTRY
 DOOR IS SECURED UPON LOSS OF POWER TO THE STRIKE
 FREE EGRESS AT ALL TIMES

HARDWARE GROUP NO. 17

FOR USE ON DOOR #(S):

2025					
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PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	3CB1HW 4.5 X 4.5	<input type="checkbox"/>		651	IVE
1	EA	STOREROOM LOCK	L9080T 03A	<input type="checkbox"/>		629	SCH
1	EA	PERMANENT FSIC CORE	23-030	<input type="checkbox"/>		626	SCH
1	EA	SURFACE CLOSER	1461 STD TBSRT 1	<input type="checkbox"/>		689	LCN

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1	EA	WALL STOP	3/4" WS404	<input type="checkbox"/>		625	IVE
1	EA	GASKETING	488SBK PSA @ HEAD & JAMBS	<input type="checkbox"/>		BK	ZER

HARDWARE GROUP NO. 18

FOR USE ON DOOR #(S):

2024A	2024B				
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PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	3CB1HW 4.5 X 4.5 NRP	<input type="checkbox"/>		651	IVE
1	EA	FIRE EXIT HARDWARE	99-L-NL- F-03	<input type="checkbox"/>		625	VON
1	EA	RIM CYLINDER	20-057 ICX	<input type="checkbox"/>		625	SCH
1	EA	PERMANENT FSIC CORE	23-030	<input type="checkbox"/>		626	SCH
1	EA	ELECTRIC STRIKE	6111 FSE 12/24 VAC/VDC	<input type="checkbox"/>	~	629	VON
1	EA	SURFACE CLOSER	4111 EDA TBSRT 1 3/4"	<input type="checkbox"/>		689	LCN
1	EA	WALL STOP	WS404	<input type="checkbox"/>		625	IVE
1	EA	GASKETING	488SBK PSA @ HEAD & JAMBS	<input type="checkbox"/>		BK	ZER
1	EA	DOOR BOTTOM	364AA-Z49	<input type="checkbox"/>		AA	ZER
1	EA	CREDENTIAL READER	BY DIVISION 28.		~		
1	EA	LOW VOLTAGE POWER	BY LOW VOLTAGE		~		

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OPERATION:

DOOR IS NORMALLY LATCHED AND SECURED
 PRESENTING VALID CREDENTIAL TEMPORARILY RELEASES STRIKE FOR ENTRY
 DOOR IS SECURED UPON LOSS OF POWER TO THE STRIKE
 FREE EGRESS AT ALL TIMES

HARDWARE GROUP NO. 19

FOR USE ON DOOR #(S):

2007B					
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PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	3CB1HW 4.5 X 4.5 NRP	<input type="checkbox"/>		651	IVE
1	EA	PANIC HARDWARE	99-L-NL-03	<input type="checkbox"/>		625	VON
1	EA	RIM CYLINDER	20-057 ICX	<input type="checkbox"/>		625	SCH
1	EA	PERMANENT FSIC CORE	23-030	<input type="checkbox"/>		626	SCH
1	EA	ELECTRIC STRIKE	6111 FS 12/24 VAC/VDC	<input type="checkbox"/>	~	629	VON
1	EA	SURFACE CLOSER	4111 EDA	<input type="checkbox"/>		689	LCN
1	EA	WALL STOP	WS404	<input type="checkbox"/>		625	IVE
1	EA	GASKETING	488SBK PSA @ HEAD & JAMBS	<input type="checkbox"/>		BK	ZER
1	EA	CREDENTIAL READER	BY DIVISION 28.		~		
1	EA	LOW VOLTAGE POWER	BY LOW VOLTAGE		~		

OPERATION:

DOOR IS NORMALLY LATCHED AND SECURED
 PRESENTING VALID CREDENTIAL TEMPORARILY RELEASES STRIKE FOR ENTRY
 DOOR IS UNSECURED UPON LOSS OF POWER TO THE STRIKE
 FREE EGRESS AT ALL TIMES

HARDWARE GROUP NO. 19A

FOR USE ON DOOR #(S):

2008					
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PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG			FINISH	MFR
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4	EA	HINGE	NUMBER 3CB1HW 4.5 X 4.5 NRP	<input type="checkbox"/>		651	IVE
1	EA	PANIC HARDWARE	99-L-NL-03	<input type="checkbox"/>		625	VON
1	EA	RIM CYLINDER	20-057 ICX	<input type="checkbox"/>		625	SCH
1	EA	PERMANENT FSIC CORE	23-030	<input type="checkbox"/>		626	SCH
1	EA	ELECTRIC STRIKE	6111 FSE 12/24 VAC/VDC	<input type="checkbox"/>	~	629	VON
1	EA	SURFACE CLOSER	4111 EDA	<input type="checkbox"/>		689	LCN
1	EA	WALL STOP	WS404	<input type="checkbox"/>		625	IVE
1	EA	GASKETING	488SBK PSA @ HEAD & JAMBS	<input type="checkbox"/>		BK	ZER
1	EA	CREDENTIAL READER	BY DIVISION 28.		~		
1	EA	LOW VOLTAGE POWER	BY LOW VOLTAGE		~		

OPERATION:

DOOR IS NORMALLY LATCHED AND SECURED
PRESENTING VALID CREDENTIAL TEMPORARILY RELEASES STRIKE FOR ENTRY
DOOR IS SECURED UPON LOSS OF POWER TO THE STRIKE
FREE EGRESS AT ALL TIMES

HARDWARE GROUP NO. 20

FOR USE ON DOOR #(S):

2026

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	3CB1HW 4.5 X 4.5 NRP	<input type="checkbox"/>		651	IVE
1	EA	POWER TRANSFER	EPT10 CON	<input type="checkbox"/>	~	689	VON
1	EA	DELAYED FIRE EXIT HARDWARE	CX99-L-F- M996-03- FS-CON- SNB 24 VDC	<input type="checkbox"/>	~	625	VON

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1	EA	RIM CYLINDER	20-057 ICX	<input type="checkbox"/>		625	SCH
1	EA	MORTISE CYLINDER	20-061 ICX (CAM & RING AS REQ'D) FOR CHEXIT)	<input type="checkbox"/>		626	SCH
2	EA	PERMANENT FSIC CORE	23-030	<input type="checkbox"/>		626	SCH
1	EA	SURFACE CLOSER	4111 EDA TBSRT 1 3/4"	<input type="checkbox"/>		689	LCN
1	EA	WALL STOP	WS404	<input type="checkbox"/>		625	IVE
1	EA	GASKETING	488SBK PSA @ HEAD & JAMBS	<input type="checkbox"/>		BK	ZER
1	EA	WIRE HARNESS (FROM DEVICE TO HINGE)	CON-XXXP (LENGTH TO SUIT) VERIFY LENGTH		~		SCH
1	EA	POWER SUPPLY WIRE HARNESS	CON-6W		~		SCH
2	EA	CREDENTIAL READER	BY DIVISION 28.		~		
1	EA	LOW VOLTAGE POWER	BY LOW VOLTAGE		~		

OPERATION:

DOOR IS NORMALLY LATCHED AND SECURED
 PRESENTING VALID CREDENTIAL FROM PULL SIDE TEMPORARILY DISARMS THE ALARM AND
 ALLOWS LEVER TO RETRACT LATCHBOLT FOR ENTRY
 PRESENTING VALID CREDENTIAL FROM PUSH SIDE TEMPORARILY DISABLES DELAYED
 EGRESS DEVICE FOR IMMEDIATE EXIT
 PUSHING ACTUATOR BAR WITHOUT PRESENTING VALID CREDENTIAL SOUNDS ALARM AND
 LATCHBOLT IS RETRACTED FOR EXIT IN 15 SECONDS; MANUALLY RESET ALARM
 DOOR IS FOR IMMEDIATE EXIT OR ENTRY UPON ACTIVATION OF FIRE ALARM SYSTEM, OR
 LOSS OF POWER TO THE DEVICE

HARDWARE GROUP NO. 21

FOR USE ON DOOR #(S):

2034E					
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PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
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2	EA	SPRING HINGE	3SP1 4.5 X 4.5	<input type="checkbox"/>		651	IVE
	EA	BALANCE HARDWARE	BY DOOR MANUFACTURER				

HARDWARE GROUP NO. 22

FOR USE ON DOOR #(S):

2034D							
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PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	3CB1HW 4.5 X 4.5	<input type="checkbox"/>		651	IVE
1	EA	POWER TRANSFER	EPT10 CON	<input type="checkbox"/>	~	689	VON
1	EA	EL MORTISE LOCK	L9093TEL 03A CON 12/24 VDC	<input type="checkbox"/>	~	625	SCH
1	EA	PERMANENT FSIC CORE	23-030	<input type="checkbox"/>		626	SCH
1	EA	SURFACE CLOSER	4011 TBSRT 1 3/4"	<input type="checkbox"/>		689	LCN
1	EA	WALL STOP	WS404	<input type="checkbox"/>		625	IVE
1	EA	GASKETING	488SBK PSA @ HEAD & JAMBS	<input type="checkbox"/>		BK	ZER
1	EA	DOOR BOTTOM	364AA-Z49	<input type="checkbox"/>		AA	ZER
1	EA	VIEWER	U698	<input type="checkbox"/>		625	IVE
1	EA	WIRE HARNESS (FROM DEVICE TO HINGE)	CON-XXXP (LENGTH TO SUIT) VERIFY LENGTH		~		SCH
1	EA	POWER SUPPLY WIRE HARNESS	CON-6W		~		SCH
2	EA	CREDENTIAL READER	BY DIVISION 28.		~		
1	EA	LOW VOLTAGE POWER	BY LOW VOLTAGE		~		

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INSTALL CYLINDER AT CORRIDOR SIDE

OPERATION:

DOOR IS NORMALLY LATCHED AND SECURED AT BOTH SIDES OF THE DOOR

PRESENTING VALID CREDENTIAL RELEASES LEVER FOR ENTRY OR EXIT

DOOR IS UNLOCKED UPON ACTIVATION OF EMERGENCY/FIRE ALARM SYSTEM, OR LOSS OF POWER TO THE LOCK

HARDWARE GROUP NO. 23

FOR USE ON DOOR #(S):

2054					
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PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	3CB1HW 4.5 X 4.5 NRP	<input type="checkbox"/>		651	IVE
1	EA	PANIC HARDWARE	99-L-NL-03	<input type="checkbox"/>		625	VON
1	EA	RIM CYLINDER	20-057 ICX	<input type="checkbox"/>		625	SCH
1	EA	PERMANENT FSIC CORE	23-030	<input type="checkbox"/>		626	SCH
1	EA	ELECTRIC STRIKE	6111 FS 12/24 VAC/VDC	<input type="checkbox"/>	~	629	VON
1	EA	SURFACE CLOSER	1461 EDA STD	<input type="checkbox"/>		689	LCN
1	EA	WALL STOP	WS404	<input type="checkbox"/>		625	IVE
1	EA	GASKETING	488SBK PSA @ HEAD & JAMBS	<input type="checkbox"/>		BK	ZER
1	EA	CREDENTIAL READER	BY DIVISION 28.		~		
1	EA	REMOTE RELEASE BUTTON	BY DIVISION 28.		~		
1	EA	LOW VOLTAGE POWER	BY LOW VOLTAGE		~		

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FIELD VERIFY EXISTING DOOR, FRAME AND HARDWARE CONDITIONS, AND PROVIDE HARDWARE AS NECESSARY

OPERATION:

DOOR IS NORMALLY LATCHED AND SECURED
 PRESENTING VALID CREDENTIAL OR PUSHING REMOTE RELEASE BUTTON TEMPORARILY
 RELEASES STRIKE FOR ENTRY
 DOOR IS UNSECURED UPON LOSS OF POWER TO THE STRIKE
 FREE EGRESS AT ALL TIMES

HARDWARE GROUP NO. DHW-1

FOR USE ON DOOR #(S):

2036	2037				
------	------	--	--	--	--

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	FULL SURFACE HINGE	205-FS 5"X 4 1/2"			FAD
1	EA	DEADBOLT - KEYED BOTH SIDES	1080A-2 X HM LOCK MOUNTING PLATE X 4C			FAD
2	EA	ESCUTCHEON PLATE	218			FAD
1	EA	DOOR PULL	212C	<input type="checkbox"/>		FAD

END OF SECTION

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SECTION 088000 GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glazing units.
- B. Glazing compounds.

1.02 RELATED REQUIREMENTS

- A. Section 081213 - Hollow Metal Frames: Glazed borrowed lites.
- B. Section 081416 - Flush Wood Doors: Glazed lites in doors.
- C. Section 081433 - Stile and Rail Wood Doors: Glazed lites in doors.

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 (Reaffirmed 2020).
- C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- E. ASTM C1036 - Standard Specification for Flat Glass; 2021.
- F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- G. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2019.
- H. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).
- I. GANA (SM) - GANA Sealant Manual; 2008.

1.04 ADMINISTRATIVE REQUIREMENTS

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

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data on Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Samples: Submit two samples 8 inches x 8 inches in size of glass units.
- E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

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

1.07 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.

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PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Float Glass Manufacturers:
 - 1. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
 - 2. Guardian Glass, LLC: www.guardianglass.com/#sle.
 - 3. Pilkington North America Inc: www.pilkington.com/na/#sle.
 - 4. Saint Gobain North America: www.saint-gobain.com/#sle.
 - 5. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
 - 6. Substitutions: See Section 016000 - Product Requirements.

2.02 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
 - 1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
 - 2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
 - 3. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
 - 4. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
 - 5. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.
- B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
 - 1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.

2.03 GLAZING UNITS

- A. GL-1 - Monolithic Safety Glazing: Non-fire-rated.
 - 1. Applications:
 - 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 safety glass as specified.
 - 3. Tint: Clear.
 - 4. Thickness: 1/4 inch (6.4 mm), nominal.
- B. GL-2 - Monolithic Safety Glazing: Fire-rated.
 - 1. Applications:
 - a. Glazed vision lites in fire rated doors.
 - 2. Glass Type: Fully tempered safety glass as specified.
 - 3. Tint: Clear.
 - 4. Thickness: 1/4 inch (6.4 mm), nominal.
- C. GL-3 - Security Glazing: Laminated glass, 2-Ply.
 - 1. Applications: Reception window at Waiting 2007.
 - 2. Tint: Clear.
 - 3. Thickness: 1/2 inch (12.7 mm).
 - 4. Outer Lite: Tempered glass.
 - 5. Interlayer: Polyvinyl butyral (PVB), thickness as required to meet performance criteria.
 - 6. Inside Lite: Tempered glass.

2.04 GLAZING COMPOUNDS

- A. Glazing Putty: Polymer modified latex, knife grade consistency; gray color.
- B. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; nonbleeding, nonstaining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.
- C. Manufacturers:
 - 1. Bostik Inc: www.bostik-us.com/#sle.
 - 2. Dow Corning Corporation: www.dowcorning.com/construction/#sle. Dow Corning Corporation: www.dowcorning.com/construction/#sle.
 - 3. Pecora Corporation: www.pecora.com/#sle.

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4. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
5. Substitutions: See Section 016000 - Product Requirements.

2.05 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 Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
 1. Manufacturers:
 - a. Pecora Corporation: www.pecora.com/#sle.
 - b. Tremco Global Sealants: www.tremcosealants.com/#sle.
 - c. Substitutions: See Section 016000 - Product Requirements.
- D. 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.

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 sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

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 nonpermanent 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.

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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.

3.07 SCHEDULES

- A. Refer to Drawings for glazing types and locations.

END OF SECTION

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SECTION 090561 COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
 - 1. Carpet tile.
 - 2. Thin-set ceramic tile and stone tile.
- B. Preparation of existing concrete floor slabs and new cementitious patching/leveling for installation of floor coverings.
- C. Testing of concrete floor slabs for moisture and alkalinity (pH).
- D. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
 - 1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.
- E. Remedial floor coatings.
- F. Remedial floor sheet membrane.

1.02 RELATED REQUIREMENTS

- A. Section 012200 - Unit Prices: Bid pricing for remediation treatments if required.
- B. Section 035400 - Cast Underlayment: Self-leveling underlayment applied as remediation treatment.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Unit Price for Alternate Flooring Adhesive: Do not include the cost of the alternate adhesive in the base bid; state on the bid form the unit price per square foot (square meter) for using the alternate adhesive, in the event such remediation is required.
- B. Unit Price for Remedial Floor Coating or Sheet Membrane: Do not include the cost of the floor coating or underlayment in the base bid; state on the bid form the unit price per square foot (square meter) for the floor coating or underlayment, installed, in the event such remediation is required.

1.04 REFERENCE STANDARDS

- A. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2022.
- B. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

1.05 SUBMITTALS

- A. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
 - 1. Moisture and alkalinity (pH) limits and test methods.
 - 2. Manufacturer's required bond/compatibility test procedure.
- B. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
 - 1. Manufacturer's statement of compatibility with types of flooring applied over remedial product.
 - 2. Manufacturer's installation instructions.
 - 3. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.
- C. Testing Agency's Report:
 - 1. Description of areas tested; include floor plans and photographs if helpful.
 - 2. Summary of conditions encountered.
 - 3. Moisture and alkalinity (pH) test reports.
 - 4. Copies of specified test methods.

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5. Recommendations for remediation of unsatisfactory surfaces.
6. Product data for recommended remedial coating.
7. Submit report directly to Owner.
8. Submit report not more than two business days after conclusion of testing.

D. Adhesive Bond and Compatibility Test Report.

1.06 QUALITY ASSURANCE

- A. Moisture and alkalinity (pH) testing will be performed by an independent testing agency employed and paid by Owner.
- B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
 1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.
- C. Contractor's Responsibility Relating to Independent Agency Testing:
 1. Provide access for and cooperate with testing agency.
 2. Confirm date of start of testing at least 10 days prior to actual start.
 3. Allow at least 4 business days on site for testing agency activities.
 4. Achieve and maintain specified ambient conditions.
 5. Notify Owner when specified ambient conditions have been achieved and when testing will start.
- D. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.
- B. Deliver materials in manufacturer's packaging; include installation instructions.
- C. Keep materials from freezing.

1.08 FIELD CONDITIONS

- A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F (18 degrees C) or more than 85 degrees F (30 degrees C).
- B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.
- B. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
 1. Thickness: 1/8 inch (3.2 mm), maximum.
 2. Use product recommended by flooring manufacturer.
- C. Remedial Floor Sheet Membrane: Pre-formed multi-ply sheet membrane installed over concrete subfloor and intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
 1. Thickness: 28 mil (0.028 inch) (0.711 mm).
 2. Tape: Types recommended by underlayment manufacturer to install membrane and cover seams.
 3. Products:
 - a. GCP Applied Technologies; Kovara MBX: www.gcpat.com/#sle.

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- b. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

- A. Perform following operations in the order indicated:
1. Preliminary cleaning.
 2. Moisture vapor emission tests; 3 tests in the first 1000 square feet (100 square meters) and one test in each additional 1000 square feet (100 square meters), unless otherwise indicated or required by flooring manufacturer.
 3. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 4. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 5. Specified remediation, if required.
 6. Patching, smoothing, and leveling, as required.
 7. Other preparation specified.
 8. Adhesive bond and compatibility test.
 9. Protection.
- B. Remediations:
1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
 2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
 3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.02 PRELIMINARY CLEANING

- A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.
- B. Do not use solvents or other chemicals for cleaning.

3.03 MOISTURE VAPOR EMISSION TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F1869 and as follows.
- D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet (1.4 kg per 93 square meters) per 24 hours.
- F. Report: Report the information required by the test method.

3.04 INTERNAL RELATIVE HUMIDITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F2170 Procedure A and as follows.

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- D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.
- F. Report: Report the information required by the test method.

3.05 ALKALINITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.06 PREPARATION

- A. See individual floor covering section(s) for additional requirements.
- B. Comply with requirements and recommendations of floor covering manufacturer.
- C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
- D. Do not fill expansion joints, isolation joints, or other moving joints.

3.07 ADHESIVE BOND AND COMPATIBILITY TESTING

- A. Comply with requirements and recommendations of floor covering manufacturer.

3.08 APPLICATION OF REMEDIAL FLOOR COATING

- A. Comply with requirements and recommendations of coating manufacturer.

3.09 INSTALLATION OF REMEDIAL FLOOR SHEET MEMBRANE

- A. Install in accordance with sheet membrane manufacturer's instructions.

END OF SECTION

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SECTION 092116 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. Cementitious backing board.
- F. Gypsum wallboard.
- G. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.
- B. Section 078400 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.

1.03 REFERENCE STANDARDS

- A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- C. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).
- D. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2018.
- E. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.
- F. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
- G. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2020.
- H. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.
- I. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.
- J. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.
- K. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2018.
- L. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
- M. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
- N. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
- O. ASTM E413 - Classification for Rating Sound Insulation; 2022.
- P. GA-216 - Application and Finishing of Gypsum Panel Products; 2021.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

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- C. Product Data: Provide data on gypsum board, accessories, and joint finishing system.
- D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
 - 1. See PART 3 for finishing requirements.
- B. Interior Partitions: Provide completed assemblies with the following characteristics:
 - 1. Acoustic Attenuation: STC as indicated calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- C. Fire-Resistance-Rated Assemblies: Provide completed assemblies complying with applicable code.
 - 1. Refer to drawings for UL listings.

2.02 METAL FRAMING MATERIALS

- A. Manufacturers - Metal Framing, Connectors, and Accessories:
 - 1. ClarkDietrich: www.clarkdietrich.com/#sle.
 - 2. Jaimes Industries: www.jaimesind.com/#sle.
 - 3. Marino: www.marinoware.com/#sle.
 - 4. R-stud, LLC: www.rstud.com/#sle.
 - 5. Phillips Manufacturing Co: www.phillipsmfg.com/#sle.
 - 6. SCAFCO Corporation: www.scafco.com/#sle.
 - 7. Steel Construction Systems: www.steelconsystems.com/#sle.
 - 8. Supreme Steel Framing System Association; Supreme Stud: www.ssfsa.com/#sle.
 - 9. Substitutions: See Section 016000 - Product Requirements.
- B. Non-structural Framing System Components: ASTM C645; 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/240 at 5 psf (L/240 at 240 Pa).
 - 1. Studs: C-shaped with knurled or embossed faces.
 - 2. Runners: U shaped, sized to match studs.
- C. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws, and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
 - 1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
 - 2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot-dipped galvanized coating.

2.03 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
 - 1. American Gypsum Company: www.americangypsum.com/#sle.
 - 2. CertainTeed Corporation: www.certainteed.com/#sle.
 - 3. Continental Building Products: www.continental-bp.com/#sle.
 - 4. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
 - 5. National Gypsum Company: www.nationalgypsum.com/#sle.
 - 6. PABCO Gypsum: www.pabcogypsum.com/#sle.
 - 7. USG Corporation: www.usg.com/#sle.
 - 8. Substitutions: See Section 016000 - 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. Application: Use for vertical surfaces, unless otherwise indicated.
 - 2. 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.
 - 3. Thickness:

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- a. Vertical Surfaces: 5/8 inch (16 mm).
- C. Backing Board For Tile Instal:
 - 1. Application: Horizontal surfaces behind tile.
 - 2. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
 - a. Regular Type: Thickness 5/8 inch (16 mm).
 - b. Fire-Resistance-Rated Type: Type X core, thickness 5/8 inch (16 mm).
 - c. Products:
 - 1) United States Gypsum Company: Durock Glass-Mat Tile Backerboard; .
 - 2) Substitutions: See Section 016000 - 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. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - 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. Type: Regular and Type X, in locations indicated.
 - 5. Type X Thickness: 5/8 inch (16 mm).
 - 6. Regular Board Thickness: 5/8 inch (16 mm).
 - 7. Edges: Square.
 - 8. Products:

2.04 GYPSUM WALLBOARD ACCESSORIES

- A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness to fit within wall cavity.
- B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
 - 1. Products:
 - a. Franklin International, Inc; Titebond GREENchoice Professional Acoustical Smoke and Sound Sealant: www.titebond.com/#sle.
 - b. Liquid Nails, a brand of PPG Architectural Coatings: www.liquidnails.com/#sle.
 - c. Specified Technologies Inc; Smoke N Sound Acoustical Sealant: www.stifirestop.com/#sle.
 - d. Substitutions: See Section 016000 - Product Requirements.
- C. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.
 - 1. Corner Beads: Low profile, for 90 degree outside corners.
 - 2. L-Trim with Tear-Away Strip: Sized to fit 5/8 inch (16 mm) thick gypsum wallboard.
 - 3. Expansion Joints:
 - a. Type: V-shaped metal with factory-installed protective tape.
- D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
 - 1. Paper Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners.
 - 2. Joint Compound: Drying type, vinyl-based, ready-mixed.
- E. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.
- F. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

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 C754 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
- C. Studs: Space studs as indicated on drawings.

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1. Extend partition framing as indicated on drawings..
 2. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- E. Blocking: Install wood blocking for support of:
1. Framed openings.
 2. Wall-mounted cabinets.
 3. Toilet accessories.
 4. Wall-mounted door hardware.
 5. Wall Mounted Displays

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 two beads continuously on substrate before installation of perimeter framing members.
 2. Place continuous bead at perimeter of each layer of gypsum board.
 3. 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.
- C. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- D. Installation on Metal Framing: Use screws for attachment of gypsum board.
- E. Installation on Wood Framing: For rated assemblies, comply with requirements of listing authority.
1. Single-Layer Applications: Screw attachment.

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.
- 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. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 2. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- B. 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).

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

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SECTION 093000 TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

- A. Section 079200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
- B. Section 090561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.03 REFERENCE STANDARDS

- A. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2017 (Reaffirmed 2022).
- B. ANSI A108.1b - Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set, Modified Dry-Set, or Improved Modified Dry-Set Cement Mortar; 2023.
- C. ANSI A108.1c - Contractor's Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set, Modified Dry-Set, or Improved Modified Dry-Set Cement Mortar; 2023.
- D. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship; 2019.
- E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive; 2023.
- F. ANSI A108.5 - Setting of Ceramic Tile with Dry-Set Cement Mortar, Modified Dry-Set Cement Mortar, EGP (Exterior Glue Plywood) Modified Dry-Set Cement Mortar, or Improved Modified Dry-Set Cement Mortar; 2023.
- G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy; 2023.
- H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2019).
- I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 2023.
- J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 2017 (Reaffirmed 2022).
- K. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2018.
- L. ANSI A108.12 - Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Modified Dry-Set Mortar; 2023.
- M. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2021).
- N. 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.
- O. ANSI A108.20 - American National Standard Specifications for Exterior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs; 2020.
- P. ANSI A118.1 - American National Standard Specifications for Dry-Set Cement Mortar; 2019.

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- Q. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2019.
- R. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2014 (Reaffirmed 2019).
- S. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2022.
- T. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products; 2018 (Reapproved 2023).
- U. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2023.

1.04 ADMINISTRATIVE REQUIREMENTS

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

1.05 SUBMITTALS

- A. See Section 013000 - 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. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.
- 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 016000 - Product Requirements, for additional provisions.
 - 2. Extra Tile: 10 square feet (1 square meters) of each size, color, and surface finish combination.

1.06 QUALITY ASSURANCE

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

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.08 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.

PART 2 PRODUCTS

2.01 TILE

- A. Porcelain Tile, Type TL-1: ANSI A137.1 standard grade.
 - 1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
 - 2. Size: 12 by 24 inch (304 by 607 mm), nominal.
 - 3. Thickness: 5/16 inch (8 mm).
 - 4. Edges: Square.
 - 5. Surface Finish: Unpolished.
 - 6. Color(s): Leading Man NTR05.
 - 7. Pattern: Notorious.
 - 8. Products:
 - a. Crossville Inc; www.crossvilleinc.com
 - b. Substitutions: See Section 016000 - Product Requirements.
- B. Porcelain Tile, Type TL-2: ANSI A137.1 standard grade.
 - 1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
 - 2. Size: 10 by 20 inch, nominal
 - 3. Thickness: 3/8 inch (9.5 mm).

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4. Edges: Square.
 5. Surface Finish: Polished.
 6. Color(s): Emerald.
 7. Pattern: Garden Party.
 8. Products:
 - a. Jeffrey Court; jeffreycourt.com
 - b. Substitutions: See Section 016000 - Product Requirements.
- C. Porcelain Tile, Type TL-3: ANSI A137.1 standard grade.
1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
 2. Size: 12 by 24 inch (304 by 607 mm), nominal.
 3. Thickness: 5/16 inch (8 mm).
 4. Edges: Square.
 5. Surface Finish: Unpolished.
 6. Color(s): Private Eye NTR02.
 7. Pattern: Notorious.
 8. Products:
 - a. Crossville Inc; www.crossvilleinc.com
 - b. Substitutions: See Section 016000 - Product Requirements.

2.02 TRIM AND ACCESSORIES

- A. Ceramic Trim: Matching cove base ceramic shapes in sizes coordinated with field tile. Locations as indicated on drawings.
1. Applications:
 - a. Inside Corners: Jointed.
 - b. Floor to Wall Joints: Cove base.
 2. Manufacturers: Same as for tile.
- B. Non-Ceramic Trim: Brushed stainless steel, style and dimensions to suit application, for setting using tile mortar or adhesive.
1. Applications:
 - a. Open edges of wall tile.
 - b. Where porcelain floor tile meets another floor finish.
 2. Transitions:
 - a. Porcelain tile to carpet: Schiene
 3. Trims:
 - a. Open Edges: JOLLY
 - 1) Provide 2 1/2 x 1 1/4 x 1/8 inch aluminum trim at top of tile in public corridor as shown in drawings
 4. Manufacturers:
 - a. Schluter-Systems: www.schluter.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.

2.03 SETTING MATERIALS

- A. Provide setting and grout materials from same manufacturer.
- B. Manufacturers:
1. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
 2. Bostik Inc: www.bostik-us.com/#sle.
 3. Custom Building Products: www.custombuildingproducts.com/#sle.
 4. LATICRETE International, Inc: www.laticrete.com/#sle.
 5. MAPEI Americas: www.mapei.com.
 6. Substitutions: See Section 016000 - Product Requirements.
- C. Dry-Set Portland Cement Mortar Bond Coat: ANSI A118.1.

2.04 GROUTS

- A. Provide setting and grout materials from same manufacturer.
- B. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
 2. Use sanded grout for joints 1/8 inch (3.2 mm) wide and larger; use unsanded grout for joints less than 1/8 inch (3.2 mm) wide.
 3. Color(s): As selected by Architect from manufacturer's full line.

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2.05 ACCESSORY MATERIALS

- A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
 - 1. Crack Resistance: No failure at 1/8 inch (3.2 mm) gap, minimum.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- 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 tile.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
 - 1. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.
 - 2. Follow moisture and alkalinity remediation procedures in Section 090561.
- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

3.03 INSTALLATION - GENERAL

- A. Install tile and thresholds and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.20, manufacturer's instructions, and TCNA (HB) recommendations.
- B. Lay tile to pattern indicated. 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. Use standard grout unless otherwise indicated.
- 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 F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated. Treat any existing cracks in slab with TCNA Method F125.
 - 1. Use uncoupling membrane under all tile unless other underlayment is indicated.
- B. Install tile-to-tile floor movement joints in accordance with TCNA (HB) Method EJ171F.

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3.05 INSTALLATION - WALL TILE

A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244.

3.06 CLEANING

A. Clean tile and grout surfaces.

3.07 PROTECTION

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

END OF SECTION

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SECTION 095100 ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

- A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

REFERENCE STANDARDS

- 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 E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Samples: Submit two full size samples illustrating material and finish of acoustical units.
- C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.04 QUALITY ASSURANCE

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

1.05 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. USG Corporation: www.usg.com/ceilings/#sle.
 - 2. Substitutions: See Section 016000 - Product Requirements.
- B. Suspension Systems:
 - 1. Same as for acoustical units.
 - 2. Substitutions: See Section 016000 - Product Requirements.

2.02 ACOUSTICAL UNITS

- A. Acoustical Units - General: ASTM E1264, Class A.
 - 1. VOC Content: As specified in Section 016116.
- B. Acoustical Panels, Type ACT-1: Painted mineral fiber, with the following characteristics:
 - 1. Classification: ASTM E1264 Type III.
 - 2. Pattern: USG Olympia Micro ClimaPlus 4230
 - 3. Size: 24 by 24 inches (610 by 610 mm).
 - 4. Thickness: 5/8 inches (16 mm).
 - 5. NRC Range: 0.6-.0.75, determined in accordance with ASTM E1264.
 - 6. Panel Edge: Finline Beveled.

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7. Color: White.
 8. Suspension System: Exposed grid.
- C. Acoustical Panels, Type ACT-2: Painted mineral fiber, with the following characteristics:
1. Classification: ASTM E1264 Type III.
 2. Pattern: Eclipse ClimaPlus 76975
 3. Size: 24 by 24 inches (610 by 610 mm).
 4. Thickness: 3/4 inch (19 mm).
 5. NRC Range: 0.7-0.80, determined in accordance with ASTM E1264.
 6. Panel Edge: Fineline Beveled.
 7. Color: White.
 8. Suspension System: Exposed grid.

2.03 SUSPENSION SYSTEM(S)

- 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.
- 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; 9/16 inch (14 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. Perimeter Moldings: Same metal and finish as grid.

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 PREPARATION

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.

3.03 INSTALLATION - SUSPENSION SYSTEM

- A. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- B. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 1. Use longest practical lengths.
- C. 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.
- D. 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.
- E. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- F. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.
- G. Do not eccentrically load system or induce rotation of runners.

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3.04 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.

3.05 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

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SECTION 096500 RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

- A. Section 090561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.
- B. Section 090561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.03 REFERENCE STANDARDS

- A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, with Editorial Revision (2020).
- B. ASTM F2195 - Standard Specification for Linoleum Floor Tile; 2018 (Reapproved 2023).
- C. 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 013000 - 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. Shop Drawings: Indicate seaming plans and floor patterns.
- D. Verification Samples: Submit two samples, 8 x 8 inch minimum in size illustrating color and pattern for each resilient flooring product specified.
- E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Flooring Material: 1 percent of each type and color.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years experience.
- B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years experience.
- C. Testing Agency Qualifications: Independent firm specializing in performing concrete slab moisture testing and inspections of the type specified in this section.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).
- D. Protect roll materials from damage by storing on end.
- E. Do not double stack pallets.

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1.07 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).

PART 2 PRODUCTS

2.01 TILE FLOORING

- A. Linoleum Tile: - Type LT Homogeneous wear layer bonded to backing, with color and pattern through wear layer thickness.
 - 1. Manufacturers:
 - a. Forbo Flooring, Inc: www.forboflooringna.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.
 - 2. Minimum Requirements: Comply with ASTM F2195, Type corresponding to type specified.
 - 3. Backing: Jute Fabric.
 - 4. Thickness: 0.100 inch (2.5 mm), minimum, excluding backing.
 - 5. Tile Size: 13.11 x 13.11 inches.
 - 6. Pattern: Marbleized.
 - 7. Color: MCT-629 Eiger.

2.02 RESILIENT BASE

- A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; style as scheduled.
 - 1. Manufacturers:
 - a. Roppe Corporation; Contours Profiled Wall Base System: www.roppe.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.
 - 2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
 - 3. Height: 4 inch (100 mm) with cove.
 - 4. Thickness: 0.125 inch (3.2 mm).
 - 5. Length: Roll.
 - 6. Color: 128 Pewter.

2.03 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.

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. Test in accordance with Section 090561.
 - 2. 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. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.
- C. Prohibit traffic until filler is fully cured.
- D. Clean substrate.

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3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- D. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
- 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.
- C. Install square tile to ashlar pattern. Allow minimum 1/2 full size tile width at room or area perimeter.

3.05 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.
- B. Miter internal corners. At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

3.06 CLEANING

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

3.07 PROTECTION

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

END OF SECTION

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SECTION 096813 TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Carpet tile, fully adhered.
- B. Matching roll carpet for direct glue installation on stairs.

1.02 RELATED REQUIREMENTS

- A. Section 090561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.
- B. Section 090561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.03 REFERENCE STANDARDS

- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016 (Reapproved 2021).
- B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, with Editorial Revision (2020).
- C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2022.
- D. CRI 104 - Standard for Installation of Commercial Carpet; 2015.
- E. 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 013000 - 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. Shop Drawings: Indicate layout of joints.
- D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.
- E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - 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 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, Type CPT-1: Tufted, manufactured in one color dye lot.
 - 1. Product: General Carpet manufactured by Mannington Commercial.
 - 2. Tile Size: 18 x 36 inch, nominal.
 - 3. Color: Chaotic 83474.
 - 4. Pattern: Automata Cryptogram.

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5. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
6. Installation: Vertical Ashlar
- B. Tile Carpeting, Type CPT-2: Tufted, manufactured in one color dye lot.
 1. Product: General Carpet manufactured by Mannington Commercial.
 2. Tile Size: 18 x 36 inch, nominal.
 3. Pile Thickness: 0.083 inch (____ mm).
 4. Color: Chaotic 82374.
 5. Pattern: Automata Seeds.
 6. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
 7. Installation: Vertical Ashlar
- C. Roll Carpet: Same manufacturer, type, color and pattern, and face fiber characteristics as carpet tile, manufactured in same color dye lot as tile.

2.02 ACCESSORIES

- A. Edge Strips: Rubber, color as selected from manufacturer's standard colors.
 1. Manufacturer: Source from flooring manufacturer.
 2. Product: Carpet Cove Cap
 3. Install: Where carpet edge is exposed
- B. Transition Strips: Rubber, color as selected from manufacturer's standard colors.
 1. Manufacturer: Source from flooring manufacturer.
 2. Product: Fusion Transition Strip
 3. Install: Where carpet transitions to resilient flooring
- C. Adhesives:
 1. Compatible with materials being adhered; maximum VOC content as specified in Section 016116.
- 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. Test in accordance with Section 090561.
 2. 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.

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- E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.
- F. Trim carpet tile neatly at walls and around interruptions.
- G. 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

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SECTION 096900 ACCESS FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Adjustable height access flooring systems.

1.02 RELATED REQUIREMENTS

- A. Section 096813 - Tile Carpeting: Finish for access flooring panels.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- C. CISCA (AF) - Recommended Test Procedures for Access Floors; 2016.
- D. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- F. NFPA 75 - Standard for the Fire Protection of Information Technology Equipment; 2024.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data sheets including loading capacities, materials, finishes, dimensions of components, profiles, and accessories.
- C. Shop Drawings: Indicate floor layout, appurtenances or interruptions, and edge details.

1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Design floor system structure layout for this project under direct supervision of a Professional Structural Engineer experienced in design of floors of the type required and licensed in the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum three years of experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Access Flooring - Adjustable Height:
 - 1. Tate Access Floors, Inc; Con-Core 1250: www.tateaccessfloors.com/#sle.
 - 2. Substitutions: See Section 016000 - Product Requirements.
 - 3. Note that intent is to match existing product and configuration. Substitutions will be considered. but Contractor will be responsible for showing equivalence to and compatibility with specified product.

2.02 PERFORMANCE REQUIREMENTS

- A. General: Comply with the following system requirements and as indicated for specified components.
 - 1. Test in accordance with CISCA (AF).
 - 2. Comply with requirements of NFPA 75.
 - 3. Accessibility: Comply with ICC A117.1 and ADA Standards.
 - 4. Structural Design Live Loads: Comply with requirements of ICC (IBC).
 - a. Uniformly Distributed Loads: In compliance with ICC (IBC) Table 1607.1, for access floor systems.
 - b. Concentrated Loads: Over an area of 2.5 feet by 2.5 feet (762 mm by 762 mm), 2000 pounds (907 kg) minimum, in compliance with ICC (IBC) Table 1607.1, for access floor systems.
 - 5. Lateral Stability: Design system for lateral stability in all directions, with or without panels in place.

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- B. Rolling Loads: Permanent deformation not to exceed 0.04 inch (1 mm), when tested in accordance with CISCA (AF).
- C. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 75, maximum; when tested in accordance with ASTM E84.

2.03 ACCESS FLOORING - ADJUSTABLE HEIGHT

- A. Factory-fabricated system consisting of removable floor panels and supporting understructure that allows access to space below floor without requiring removal of panels other than the one directly above the space to which access is needed; provide components and accessories required for complete installation.
- B. Finishes Floor Elevation: Match level of existing raised platform at jury area. It is believed the top of the existing access floor is 6" above the building structural floor.
- C. Configuration:
 - 1. Lay-in panels on snap-on stringer understructure.
- D. Components:
 - 1. Pedestal Assembly:
 - a. Material: Steel.
 - b. Finish: Manufacturer's standard.
 - c. Base: Manufacturer's standard shape and size in accordance with system performance requirements.
 - d. Column: Threaded supporting rod to permit 1-1/2 inch (38 mm) adjustment.
 - 2. Stringers: Steel channels, box, or tee sections.
 - 3. Floor Panels:
 - a. Construction:
 - 1) Steel pan with exposed lightweight concrete fill.
 - 4. Floor Covering: Field applied, as indicated.
 - a. Carpet Tile: As specified in Section 096813.

2.04 ACCESSORIES - ADJUSTABLE HEIGHT

- A. Fascia Panels: Laminated construction as follows:
 - 1. Front and Back Face Sheets: Galvanized sheet steel.
 - 2. Core: Plywood.
 - 3. Accessories: Include corner pieces, trim, reinforcing, and clip angles.
- B. Electrostatic Grounding Connectors: Solid copper.
- C. Gaskets: Closed cell sponge rubber, preformed to suit.
- D. Sealant: Any water-based, moisture-curing, or chemically-curing joint sealant suitable for purpose and compatible with materials being sealed; except acrylic latex emulsion.

2.05 FABRICATION

- A. Fabrication Tolerances:
 - 1. Floor Panel Flatness: Plus or minus 0.02 inch (0.5 mm) in any direction.
 - 2. Floor Panel Width or Length From Specified Size: Plus or minus 0.02 inch (0.5 mm).
 - 3. Floor Panel Squareness: Plus or minus 0.03 inch (0.8 mm) difference between opposite diagonal dimensions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify field measurements are as indicated on shop drawings.
- B. Verify that substrates comply with tolerances, dimensioned clearances, and other requirements specified in other sections, and that substrates are clean, dry, and free of conditions and deleterious substances that might interfere with system installation.
- C. Verify that required utilities are available, in proper location, and are ready for use.
- D. Start of installation constitutes acceptance of project conditions.

3.02 PREPARATION

- A. Vacuum clean substrate surfaces.

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3.03 INSTALLATION - ADJUSTABLE HEIGHT ACCESS FLOORING

- A. Install components in accordance with manufacturer's instructions.
- B. Secure pedestal base plate to subfloor with adhesive.
- C. Close field cut floor panels with edge trim.
- D. Provide floor with edge trim and end closures. Provide lateral braces at stair edges and other locations where pedestals are not braced.
- E. Provide gaskets and sealant to ensure airtight seal where holes are cut in elevated floor for penetration of cable.
- F. Provide positive electrical earth grounding of entire floor assembly in accordance with NFPA 75.
- G. Fascia Panels:
 - 1. Install fascia panels at exposed sides.
 - 2. Secure panels to clip angles attached to structural floor and edge of floor panels.
 - 3. Install metal trim at intersection of fascia panels and access floor and at abutting walls and columns.

3.04 TOLERANCES

- A. Maximum Out of Level Floor Panel Tolerance: 1/16 inch in 10 ft (1.6 mm in 3 m), non-cumulative.

3.05 ADJUSTING

- A. Adjust pedestals to achieve a level floor and to assure adjacent floor panel surfaces are flush.

3.06 CLOSEOUT ACTIVITIES

- A. See Section 017800 - Closeout Submittals, for closeout submittals.

3.07 PROTECTION

- A. Do not permit traffic over unprotected floor surface.

END OF SECTION

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SECTION 097500 STONE FACING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Independently supported stone veneer at interior walls.

1.02 RELATED REQUIREMENTS

- A. Section 079200 - Joint Sealants: Sealing joints indicated to be left open for sealant.

1.03 REFERENCE STANDARDS

- A. ASTM A580/A580M - Standard Specification for Stainless Steel Wire; 2023.
- B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.
- C. ASTM C119 - Standard Terminology Relating to Dimension Stone; 2022.
- D. ASTM C503/C503M - Standard Specification for Marble Dimension Stone; 2023.
- E. ASTM C1528/C1528M - Standard Guide for Selection of Dimension Stone; 2020.
- F. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect stone from discoloration during storage on site.
- B. Provide ventilation to prevent condensation from forming on stone.
- C. Store stone off the ground and under cover. Store stone panels vertically on edge, resting weight on panel edge.
- D. Protect materials during handling and installation to prevent damage or contamination.
- E. Store dry materials off ground and under shelter from water.
- F. Store liquid materials off ground and covered.
- G. Protect liquid materials from freezing.

1.06 FIELD CONDITIONS

- A. Maintain ambient air between 50 to 90 degrees F (10 to 32 degrees C) prior to, during, and for 48 hours after completion of work.

PART 2 PRODUCTS

2.01 STONE

- A. Stone, General: See recommendations in ASTM C1528/C1528M.
- B. MarbleST-1.
 - 1. Color: Empress Green.
 - 2. Surface Finish: Polished; as described in ASTM C119 and ASTM C1528/C1528M.
 - 3. Products:
 - a. International Marble and Granite; Denver, CO.
 - b. Substitutions: See Section 016000 - Product Requirements.

2.02 STONE FABRICATION

- A. Stone Veneer:
 - 1. Nominal Thickness: 3/4 inches (19 mm).

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2.03 ACCESSORIES

- A. Wall Ties: Formed steel wire, at least 1/2 inch (13 mm) diameter, stainless steel complying with ASTM A580/A580M, eye and pintle type and wall strap for screw attachment to studs, with provision for vertical adjustment after attachment.
- B. Other Anchors in Direct Contact with Stone: ASTM A666 Type 304, stainless steel, of sizes and configurations required for support of stone and applicable superimposed loads.
- C. Setting Buttons and Shims: Lead.
- D. Cleaning Solution: Type that will not harm stone, joint materials, or adjacent surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that support work and site conditions are ready to receive work of this section.
- B. Verify that substrates to receive mortar scratch coat or setting bed comply with stone veneer manufacturer's instructions.
- C. Verify that items built-in under other sections are properly located and sized.

3.02 STONE VENEER

- A. Preparation:
 - 1. Establish lines, levels, and courses. Protect from disturbance.
 - 2. Clean stone prior to installation. Do not use wire brushes or implements that mark or damage exposed surfaces.
 - 3. Clean sawn surfaces of rust stains and iron particles.
- B. Installation:
 - 1. Size stone units to fit opening dimensions and perimeter conditions.
 - 2. Arrange stone pattern to provide color uniformity and minimize visual variations. Provide a uniform blend of stone unit sizes.
 - 3. Arrange stone coursing with consistent joint width.
- C. Reinforcement and Anchorage:
 - 1. Attach wall ties to back-up to bond veneer to back-up at maximum 16 inches (400 mm) on center vertically and 36 inches (900 mm) on center horizontally.
 - 2. Place wall ties at maximum 3 inches (75 mm) on center each way around perimeter of openings, within 12 inches (300 mm) of openings.
 - 3. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches (400 mm) on center.
- D. Joints:
 - 1. Leave the following joints open for sealant specified in Section 079200:
 - a. Joints in projecting units.
 - b. Joints below lugged sills and stair treads.
 - c. Joints below ledge and relieving angles.
 - d. Joints labeled "expansion joint."
 - 2. Pack mortar into joints and work into voids. Neatly tool surface to concave joint.
 - 3. At joints to be sealed, clean mortar out of joint before it sets. Brush joints clean.

3.03 CONTROL AND EXPANSION JOINTS

- A. Form joints as detailed on drawings.
- B. Discontinue lath, scratch coat, and setting bed at movement joints in adhered veneer.

3.04 TOLERANCES

- A. Install stone masonry within the site tolerances found in TMS 402/602.

3.05 CLEANING

- A. Remove excess mortar as work progresses and upon completion of work.
- B. Clean soiled surfaces with cleaning solution.

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C. Use nonmetallic tools in cleaning operations.

END OF SECTION

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SECTION 097800 INTERIOR WALL PANELING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Laminated interior wall paneling.
- B. Accessories.

1.02 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturer's descriptive literature for each specified product. Include anchorage devices specific to project substrate types.
- C. Shop Drawings: Submit elevations for each application and location. Indicate details of joints and attachments.
- D. Samples: Submit two samples 12 by 12 inches (300 by 300 mm) in size, indicating finish, surface design, and color for each type of panels.
- E. Warranty Documentation: Manufacturer warranty; ensure that forms have been completed in Owner's name and registered with manufacturer.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Panels: Quantity equal to 5 percent of total installed.

1.04 QUALITY ASSURANCE

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

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to project site in manufacturer's original packaging, marked with manufacturer's product identification.
- B. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

1.06 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Laminated Interior Wall Paneling:
 - 1. Marlite, Inc; Sieva Wall System: www.marlite.com
 - 2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 REGULATORY REQUIREMENTS

- A. Surface Burning Classification: Provide wall paneling assemblies meeting Class A when tested in accordance with ASTM E84.

2.03 LAMINATED INTERIOR WALL PANELING

- A. Laminated Wall Panels:
 - 1. Applications: Wall cladding.
 - 2. Panel Size: As indicated on drawings.
 - 3. Thickness: 3/8 inch (9 mm).
 - 4. Edges: Square.

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- B. Materials:
 - 1. Substrate/Core: Oriented strand board.
 - 2. Facing: High pressure laminate.
 - a. Color: PLAM -1: Formica Glamour Cherry 6208-43.
- C. Fabrication: Shop fabricate to greatest extent possible.
- D. Accessories:
 - 1. Adhesive/Joint Filler: Concrete wall adhesive, single-component, high-solids, modified-silane polymer with low VOC content, low odor, and no shrinkage.
 - 2. Trims: Extruded Aluminum, prefinished
 - a. Reveals: 1/4" Narrow Reveal

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions and substrate flatness before starting work.
- B. Verify that substrate surfaces for adhered items are clean and smooth.
 - 1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer.
- C. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION

- A. Install panels in accordance with manufacturer's instructions.
- B. Apply adhesive to back side of panel using trowel recommended by adhesive manufacturer.
- C. Apply panels to wall with vertical joints plumb and horizontal joints level and pattern aligned with adjoining panels.
- D. Using a roller, apply pressure to panel face to ensure proper adhesion between surfaces.
- E. Install panels with manufacturer's recommended gaps for panel field and corner joints.
- F. Install trim with adhesive.
- G. Seal joints at wall base and between panels with approved sealant to prevent moisture intrusion.
- H. Remove excess sealant after paneling is installed and prior to curing.

3.03 CLEANING

- A. Clean panel faces using cleaning agents and methods recommended by manufacturer to remove soiling.

3.04 PROTECTION

- A. Protect installed interior wall paneling from subsequent construction operations.

END OF SECTION

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SECTION 098430 SOUND-ABSORBING WALL AND CEILING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sound-absorbing panels.

1.02 REFERENCE STANDARDS

- A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2023.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- C. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests; 2023.

1.03 SUBMITTALS

- A. See Section 013000 - 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 and fabric 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 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 FABRIC-COVERED SOUND-ABSORBING UNITS

- A. Manufacturers:
 - 1. ConWed; Respond A Panels: www.conwed.com.
 - 2. Substitutions: See Section 016000 - Product Requirements.
 - 3. Note that intent is to match existing product and configuration. Substitutions will be considered, but Contractor will be responsible for showing equivalence to and compatibility with specified product.
- B. General:
 - 1. 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. Fabric-Covered Acoustical Panels for Walls and Ceilings:
 - 1. Panel Core: Manufacturer's standard rigid or semi-rigid fiberglass core.
 - 2. Sound Absorption: Noise Reduction Coefficient (NRC) of not less than 0.80 when tested in accordance with ASTM C423 for Type A mounting, per ASTM E795.
 - 3. Panel Sizes: Refer to elevations. Intent is to match sizes in existing courtroom, verify on site.
 - 4. Panel Thickness: 1 inch (24 mm).
 - 5. Edges: Perimeter edges reinforced by a formulated resin hardener. Beveled to match existing.
 - 6. Fabric:
 - a. AM-1: Guilford of Maine, Spinel, Color 1.
 - b. AM-2: Guilford of Maine, Spinel, Color 2.
 - 7. Color: As selected by Architect from manufacturer's full range.
 - 8. Mounting Method: It is believed that the existing panels are back-mounted with mechanical fasteners. Match existing mounting method.

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2.02 FABRICATION

- A. Fabric Wrapped, General: Fabricate panels to sizes and configurations as needed, with fabric facing 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

- A. Back-Mounting Accessories: Manufacturer's standard accessories for concealed support, designed to allow panel removal:

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.

3.03 CLEANING

- A. Clean fabric facing 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

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SECTION 099123 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.
- 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. Floors, unless specifically indicated.
 - 6. Brick, architectural concrete, cast stone, integrally colored plaster, and stucco.
 - 7. Glass.
 - 8. Concealed pipes, ducts, and conduits.

1.02 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. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

1.03 SUBMITTALS

- A. See Section 013000 - 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.
 - 4. Manufacturer's installation instructions.
- 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.
- D. Manufacturer's Instructions: Indicate special surface preparation procedures.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - 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.

1.04 QUALITY ASSURANCE

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

1.05 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.

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- 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.

1.06 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. 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. Paints:
 - 1. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
- C. Primer Sealers: Same manufacturer as top coats.
- D. Substitutions: See Section 016000 - 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. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 3. 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:
 - 1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - b. Architectural coatings VOC limits of the State in which the Project is located.
 - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Colors: As indicated on drawings.

2.03 PAINT SYSTEMS - INTERIOR

- A. Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board.
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): Institutional Low Odor/VOC Interior Latex.
 - a. Products:
 - 1) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Eg-shell. At ceilings.
 - 2) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Low Sheen. (MPI #144)
- B. Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals:
 - 1. Medium duty applications include door frames and handrails.
 - 2. Two top coats and one coat primer.
 - 3. Top Coat(s): Interior Light Industrial Coating, Water Based; MPI #151, 153, or 154.
 - a. Products:
 - 1) Sherwin-Williams Pro Industrial Acrylic Coating, Semi-Gloss. (MPI #153)
 - 2) Substitutions: See Section 016000 - Product Requirements
- C. Medium Duty Vertical: Including gypsum board. Provide paint in toilet rooms, storage rooms, and other wet locations.
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): Interior Light Industrial Coating, Water Based.

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- a. Products:
 - 1) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Semi-Gloss. (MPI #153)
 - 2) Substitutions: See Section 016000 - Product Requirements

2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
 1. Interior Institutional Low Odor/VOC Primer Sealer.
 - a. Products:
 - 1) Sherwin Williams ProMar 200 Zero VOC Interior Latex Primer.
 - 2) Substitutions: See Section 016000 - Product Requirements
 2. Interior Rust-Inhibitive Water Based Primer; Touch-up at pre-primed hollow metal doors and frames.
 - a. Products:
 - 1) Sherwin-Williams Pro-Cryl Universal Primer. (MPI #107)

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. 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.

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. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- F. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- B. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- 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.

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3.05 PROTECTION

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

3.06 COLOR SCHEDULE

- A. PNT-1: Sherwin Williams 1059 Off White
- B. PNT-2: Sherwin Williams 1097 Yorkshire Brown
- C. PNT-3: Sherwin Williams 1900 Luminous White Satin

END OF SECTION

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SECTION 099300 STAINING AND TRANSPARENT FINISHING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of stains and transparent finishes.

1.02 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. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

1.03 SUBMITTALS

- A. See Section 013000 - 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.
 - 2. Manufacturer's installation instructions.
- C. Samples: Submit two samples, illustrating selected colors and sheens for each system with specified coats cascaded. Submit on actual wood substrate to be finished, Approx. 8 x 8 inch (____x____ mm) in size.
- D. Manufacturer's Instructions: Indicate special surface preparation procedures.

1.04 QUALITY ASSURANCE

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

1.05 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 stain or transparent finish, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Stain and Transparent Finish 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.

1.06 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by manufacturer of stains and transparent finishes.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Minimum Application Temperature: 50 degrees F (10 degrees C) unless required otherwise by manufacturer's instructions.
- D. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide finishes used in any individual system from the same manufacturer; no exceptions.
- B. Transparent Finishes:

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1. Sherwin-Williams Company: www.sherwin-williams.com.
- C. Stains:
 1. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
- D. Substitutions: See Section 016000 - Product Requirements.

2.02 STAINS AND TRANSPARENT FINISHES - GENERAL

- A. Finishes:
 1. Provide finishes 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. Supply each finish material in quantity required to complete entire project's work from a single production run.
 4. Do not reduce, thin, or dilute finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
 1. Provide stains and transparent finishes that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - b. Architectural coatings VOC limits of State in which the project is located.
 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- 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: To be selected from manufacturer's full range of available colors.
 1. Selection to be made by Architect after award of contract.

2.03 INTERIOR STAIN AND TRANSPARENT FINISH SYSTEMS

- A. Finish on Wood - Vertical Surfaces:
 1. Sealer: Alkyd, Sanding Sealer, Clear; MPI #102.
 2. Top Coat(s): Polyurethane Varnish, High Build.
 - a. Products:
 - 1) Sherwin-Williams MinWax High Build Polyurethane, Satin.
 - 2) Substitutions: Section 016000 - Product Requirements.
 3. Top Coat Sheen:
 - a. Satin: MPI gloss level 4; use this sheen at all locations.

2.04 ACCESSORY MATERIALS

- A. Accessory Materials: Cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of finished surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin application of stains and finishes until substrates have been properly 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 effect proper application.

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.

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- 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. Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

3.03 APPLICATION

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- D. Sand wood surfaces lightly between coats to achieve required finish.
- E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- F. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- G. Reinstall items 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

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SECTION 101423 PANEL SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Panel signage.

1.02 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.03 SUBMITTALS

- A. See Section 013000 - 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. Samples: Submit one sample of each type of sign, of size similar to that required for project, indicating sign style, font, and method of attachment.
- E. Selection Samples: Where colors, materials, and finishes are not specified, submit two sets of color selection charts or chips.
- F. Manufacturer's qualification statement.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements for additional provisions.
 - 2. Curved Sign Media Suction Cups: One for each 100 signs; for removing media.

1.04 QUALITY ASSURANCE

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

1.05 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.

1.06 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/#sle.

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2. FASTSIGNS International, Inc: www.fastsigns.com/#sle.
3. Inpro Corporation: www.inprocorp.com/#sle.
4. Takeform: www.takeform.net/#sle.
5. ASI Signage: www.asisignage.com.
6. Bud's Signs: www.buds-signs.com
7. Substitutions: See Section 016000 - 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 for interior:
 1. Application: Room and door signs.
 2. Description: Flat signs with applied character panel media, tactile characters.
 3. Sign Size: As indicated on drawings.
 4. Total Thickness: 1/8 inch (3 mm).
 5. Sign Edges: Squared.
 6. 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.
 7. Material: Acrylic plastic base with applied plastic letters and braille.
 8. Tactile Letters: Raised 1/32 inch minimum.
 9. Braille: Grade II, ADA-compliant.

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.
 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 interior panel signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- D. Protect from damage; repair or replace damaged items.

END OF SECTION

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SECTION 102239 FOLDING PANEL PARTITIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Top-supported folding panel partitions, horizontal opening.

1.02 REFERENCE STANDARDS

- A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- D. ASTM E557 - Standard Guide for Architectural Design and Installation Practices for Sound Isolation Between Spaces Separated by Operable Partitions; 2012 (Reapproved 2020).
- E. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics; 2020.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on partition materials, operation, hardware and accessories, electric operating components, track switching components, and colors and finishes available.
- C. Shop Drawings: Indicate opening sizes, track layout, details of track and required supports, static and dynamic loads, location and details of pass door and frame, adjacent construction and finish trim, and stacking depth.
- D. Samples for Selection: Submit two samples of full manufacturer's color range for selection of colors.

1.04 QUALITY ASSURANCE

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

1.05 DELIVERY, STORAGE, AND HANDLING

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

1.06 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide two year manufacturer warranty against defects in material and workmanship, excluding abuse.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Folding Panel Partitions - Horizontal Opening:
 - 1. Moderco, Inc: www.moderco.com/#sle.
 - 2. Modernfold, a DORMA Group Company: www.modernfold.com/#sle.
 - 3. Substitutions: See Section 016000 - Product Requirements.

2.02 FOLDING PANEL PARTITIONS - HORIZONTAL OPENING

- A. Folding Panel Partitions: Center opening; paired panels; center stacking; manually operated.
- B. Panel Construction:
 - 1. Frame: 16 gauge, 0.0598 inch (1.52 mm) thick formed sheet steel frame top, bottom, jambs, and intermediates; welded construction, with acoustical insulation fill.
 - 2. Panel Substrate Facing: Steel sheet, manufacturer's standard thickness.
 - 3. Hinges: Continuous piano type, () stainless steel.

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4. Panel Properties:
 - a. Thickness With Finish: 3 inches (75 mm).
 - b. Width: Standard width.
- C. Panel Finishes:
 1. Facing: Vinyl coated fabric.
- D. Panel Seals:
 1. Panel to Panel Seals: Grooved and gasketed astragals, with continuous flexible ribbed vinyl seal fitted to panel edge construction; color to match panel finish.
 2. Acoustic Seals: Flexible acoustic seals at jambs, meeting mullions, ceilings, retractable floor and ceiling seals, and above track to structure acoustic seal.
- E. Suspension System:
 1. Track: Formed steel; 1-1/4 by 1-1/4 inch (32 by 32 mm) size; thickness and profile designed to support loads, steel sub-channel and track connectors, and track switches.
 2. Carriers: Nylon wheels on trolley carrier at top of every second panel, sized to carry imposed loads, with threaded pendant bolt for vertical adjustment.
- F. Performance:
 1. Acoustic Performance:
 - a. Sound Transmission Class (STC): 48 to 52 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90, on panel size of 100 sq ft (9.3 sq m).
 2. Surface Burning Characteristics of Panel Finish: Flame spread/smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.
 3. Installed partition system track capable of supporting imposed loads, with maximum deflection of 1/360 of span.
- G. Accessories:
 1. Ceiling Closure: White enameled ceiling closure; aluminum jamb and head molding, fittings and attachments.
 2. Acoustic Sealant: As recommended by partition manufacturer.

2.03 MATERIALS

- A. Aluminum Extrusions: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- B. Vinyl Coated Fabric: ASTM F793 Category VI, polyvinyl fluoride (PVC) finish for washability and improved flame retardance; color as selected by Architect from manufacturer's standard range.
- C. Acoustic Insulation:
 1. Type: As required for acoustic performance indicated.
 2. Thickness: As required for acoustic performance indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.

3.02 INSTALLATION

- A. Install partition in accordance with manufacturer's instructions and ASTM E557.
- B. Install acoustic sealant to achieve required acoustic performance.

3.03 ADJUSTING

- A. Adjust partition assembly to provide smooth operation from stacked to full open position. Do not over-compress acoustic seals.
- B. Visually inspect partition in full extended position for light leaks to identify a potential acoustical leak.
- C. Adjust partition assembly to achieve lightproof seal.

3.04 CLEANING

- A. Clean finish surfaces and partition accessories.

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3.05 CLOSEOUT ACTIVITIES

- A. Demonstrate operation of partition and identify potential operational problems.

END OF SECTION

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SECTION 102600 WALL AND DOOR PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Corner guards.

1.02 REFERENCE STANDARDS

- A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2023, with Editorial Revision.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- C. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies; 2023.

1.03 SUBMITTALS

- A. See Section 013000 - 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. Shop Drawings: Include plans, elevation, sections, and attachment details. Show design and spacing of supports for protective corridor handrails, required to withstand structural loads.
- D. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
 - 1. Submit two sections of corner guards, 24 inches (610 mm) long.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:
 - 1. See Section 016000 - 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.

1.04 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. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Corner Guards:
 - 1. Construction Specialties, Inc: www.c-sgroup.com/#sle.
 - 2. Inpro: www.inprocorp.com/#sle.
 - 3. Substitutions: See Section 016000 - 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.

2.03 PRODUCT TYPES

- A. Corner Guards - Surface Mounted:
 - 1. Material: Polyethylene terephthalate (PET or PETG); PVC-free with full height extruded aluminum retainer.
 - 2. Performance: Resist lateral impact force of 100 lbs (445 N) at any point without damage or permanent set.
 - 3. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 - 4. Width of Wings: 2 inches (51 mm).
 - 5. Corner: Square.
 - 6. Color: As selected from manufacturer's standard colors.
 - 7. Length: One piece.

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2.04 FABRICATION

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

2.05 SOURCE QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

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 52 inches.

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).

END OF SECTION

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SECTION 102641 BALLISTICS RESISTANT PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Laminated fiberglass ballistics-resistant panels.

1.02 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- B. UL 752 - Standard for Bullet-Resisting Equipment; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's current data sheets on each product to be used.
- C. Shop Drawings: Details of installation of ballistics-resistant panels, including plan views, elevations, sections, and details of the proposed installation with attachment methods.
- D. Warranty Documentation: Manufacturer warranty; ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

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

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging bearing the brand name, manufacturer's identification, and required UL and NIJ certification labels until ready for installation.
- B. Handle material with care to prevent damage. Stack panels flat, store inside under cover off the ground in a dry location, and protect from other construction activities.

1.07 FIELD CONDITIONS

1.08 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide ten year manufacturer warranty for materials and workmanship against defects commencing on the Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Laminated Glass Fiber Ballistics-Resistant Panels:
 - 1. Armortex: www.armortex.com/#sle.
 - 2. Substitutions: See Section 016000 - Product Requirements.

2.02 LAMINATED FIBER BALLISTICS-RESISTANT PANELS

- A. General:
 - 1. Laminated fiber ballistics-resistant panels to be non-ricochet type. When struck by a bullet or projectile, the panels to delaminate in such a way that absorbs the energy, stops the projectile, and prevents ricochet or spalling.
- B. Performance Requirements:
 - 1. Ballistics Resistance Rating: Listed and labeled as tested in accordance with UL 752 Level 3 (super-power handgun) threat rating.

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2. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when tested in accordance with ASTM E84.
- C. Laminated Fiber Panels:
 1. Material: Multiple layers of fiberglass woven roving bonded together with resin and compressed into flat rigid sheets.
 2. Panel Size: 3 ft by 8 ft (914 mm by 2438 mm).
 3. Panel Thickness: Minimum thickness required for selected UL 752 threat level.
 4. Panel Weight: Minimum weight required for selected UL 752 threat level.
 5. Attachment Method: Mechanical fasteners.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Verify that substrates have been properly prepared.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation of this work.

3.03 INSTALLATION

- A. Install panels in accordance with manufacturer's instructions and shop drawings and in proper relationship with adjacent construction.
 1. Maintain ballistics-resistive rating at panel junctures with concrete floor and roof slabs, bullet-resistive door and window frames, and required penetrations.
- B. Secure panels using screws, bolts, or industrial adhesive.

3.04 PROTECTION

- A. Protect installed panels from subsequent construction operations.

END OF SECTION

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SECTION 102800 TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Commercial toilet accessories.
- B. Institutional ligature-resistant toilet accessories.
- C. Utility room accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Concealed supports for accessories, including in wall framing and plates and above ceiling framing.
- B. Section 093000 - Tiling: Ceramic washroom accessories.
- C. Section 102113.16 - Plastic-Laminate-Clad Toilet Compartments.
- D. Section 224000 - Plumbing Fixtures: Under-lavatory pipe and supply covers.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2022.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.
- F. ASTM B86 - Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings; 2022.
- G. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2017 (Reapproved 2022).
- H. ASTM C1036 - Standard Specification for Flat Glass; 2021.
- I. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- J. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2018.
- K. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2021.
- L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- M. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2022.
- N. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

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PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Toilet Accessory Abbreviations:
 - 1. TA-1: Toilet Paper Dispenser - FBO
 - 2. TA-2: Paper Towel Dispenser - FBO
 - 3. TA-3: Soap Dispenser - FBO
 - 4. TA-4: Waste Receptacle - FBO
 - 5. TA-5: Mirror
 - 6. TA-6: Grab Bars
 - 7. TA-7: Not Used
 - 8. LR-1: Security Toilet Paper Holder
 - 9. LR-2: Security Paper Towel Holder
 - 10. LR-3: Security Mirror
 - 11. LR-4: Security Grab Bars
- B. Commercial Toilet, Shower, and Bath Accessories:
 - 1. American Specialties, Inc: www.americanspecialties.com/#sle.
 - 2. Bradley Corporation: www.bradleycorp.com/#sle.
 - 3. Georgia-Pacific Professional: www.blue-connect.com/#sle.
 - 4. Bobrick: www.bobrick.com
 - 5. Whitehall Manufacturing: www.whitehallmfg.com
 - 6. Substitutions: Section 016000 - Product Requirements.

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.
- B. Stainless Steel Sheet: ASTM A666, Type 304.
- C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- D. Zinc Alloy: Die cast, ASTM B86.
- 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. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.
- G. Adhesive: Two component epoxy type, waterproof.
- H. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
- I. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.
- B. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.

2.04 COMMERCIAL TOILET ACCESSORIES

- A. TA-5: Mirrors: Stainless steel framed, 1/4 inch (6 mm) thick annealed float glass; ASTM C1036.
 - 1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
 - 2. Size: 18 inches X 36 inches.
 - 3. Frame: 0.05 inch (1.3 mm) angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
 - 4. Backing: Full-mirror sized, minimum 0.03 inch (0.8 mm) galvanized steel sheet and nonabsorptive filler material.
 - 5. Products:
 - a. Substitutions: Section 016000 - Product Requirements.

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- B. TA-6: Grab Bars: Stainless steel, peened surface.
 - 1. Standard Duty Grab Bars:
 - a. Push/Pull Point Load: 250 pound-force (1112 N), minimum.
 - b. Dimensions: 1-1/4 inch (32 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, exposed flange mounting, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar.
 - c. Finish: Satin.
 - d. Length and Configuration: As indicated on drawings.
 - e. Products:
 - 1) Substitutions: Section 016000 - Product Requirements.

2.05 INSTITUTIONAL SECURITY AND LIGATURE-RESISTANT TOILET AND BATH ACCESSORIES

- A. LR-1: Toilet Paper Holder: Single roll, surface-mounted unit with beveled wall flange, white powder coated stainless steel for standard toilet paper rolls. Install with tamper-resistant screws.
 - 1. Products:
 - a. Whitehall Manufacturing; www.whitehallmfg.com: BestCare WH1847B.
 - b. Substitutions: Section 016000 - Product Requirements.
- B. LR-2: Paper Towel Holder: Folded paper type, single bay, white powder coated stainless steel, surface-mounted, with open bays as refill indicators. Install with tamper-resistant screws.
 - 1. Capacity: 250 C-fold minimum per bay.
 - 2. Products:
 - a. Whitehall Manufacturing; www.whitehallmfg.com: BestCare WH1181-1.
 - b. Substitutions: Section 016000 - Product Requirements.
- C. LR-3: Mirrors: Unframed, Type 400 polished stainless steel mirror; exposed front mount.
 - 1. Framed Size: 13 inches by 16 inches (330 mm by 406 mm).
 - 2. Products:
 - a. American Specialties, Inc; www.americanspecialties.com; Model 105-14.
 - b. Substitutions: Section 016000 - Product Requirements.
- D. LR-4: Grab Bars: Type 304 stainless steel, smooth surface with closure plate.
 - 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, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar; 14 gauge stainless steel "L" shaped closure plate with wall mounting flange welded to bottom of tube to prevent ligature. Install grab bar and closure plate with tamper-resistant screws through grab bar circular mounting flange and wall flange of flat closure.
 - c. Finish: Satin.
 - d. Length and Configuration: As indicated on drawings.
 - e. Products:
 - 1) American Specialties; www.americanspecialties.com; Security Grab Bar.
 - 2) Substitutions: Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.
- D. Verify that field measurements are as indicated on drawings.

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.

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- 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

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SECTION 104400 FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

- A. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

- A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.
- B. NFPA 10 - Standard for Portable Fire Extinguishers; 2022.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher operational features.
- C. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.
- D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- E. 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; Cosmic Extinguisher - Multipurpose Chemical: www.activarcpg.com/#sle.
 - 2. Nystrom, Inc: www.nystrom.com/#sle.
 - 3. Oval Brand Fire Products; Oval Dry Chemical Fire Extinguisher - Multipurpose ABC: www.ovalfireproducts.com/#sle.
 - 4. Potter-Roemer: www.potterroemer.com/#sle.
 - 5. Substitutions: See Section 016000 - Product Requirements.
- B. Fire-rated Fire Extinguisher Cabinets and Accessories:
 - 1. Activar Construction Products Group, Inc. - JL Industries; Ambassador Series: www.activarcpg.com/#sle.
 - 2. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.
 - 3. Nystrom, Inc: www.nystrom.com/#sle.
 - 4. Oval Brand Fire Products; Cabinets for Low Profile Extinguishers: www.ovalfireproducts.com/#sle.
 - 5. Potter-Roemer: www.potterroemer.com/#sle.
 - 6. Substitutions: See Section 016000 - Product Requirements.

2.02 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
 - 1. Class: A:B:C type.
 - 2. Size: 10 pound (4.54 kg).
 - 3. Size and classification as scheduled.
 - 4. Finish: Baked polyester powder coat, color as selected.

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5. Temperature range: Minus 40 degrees F (Minus 40 degrees C) to 120 degrees F (49 degrees C).

2.03 FIRE-RATED FIRE EXTINGUISHER CABINETS

- A. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.
- B. Fire-Rated Cabinet Construction: One-hour fire rated.
 1. Steel; double wall or outer and inner boxes with 5/8 inch (15.9 mm) thick fire barrier material.
- C. Cabinet Configuration: Semi-recessed type.
 1. Size to accommodate accessories.
- D. 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.
- E. Door Glazing: None.
- F. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- G. Finish of Cabinet Exterior Trim and Door: No.4 - Brushed stainless steel.
- H. Finish of Cabinet Interior: White colored enamel.

2.04 ACCESSORIES

- A. Lettering: FIRE EXTINGUISHER decal, or vinyl self-adhering, pre-spaced red 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. Install cabinets plumb and level in wall openings, 36 inches from finished floor to inside bottom of cabinet.
- C. Secure rigidly in place.
- D. Place extinguishers in cabinets.
- E. Position cabinet signage at latch side of door where applicable.

END OF SECTION

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SECTION 122113 HORIZONTAL LOUVER BLINDS

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

- A. Section 061000 - 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 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the placement of concealed blocking to support blinds. See Section 061000.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate opening sizes, tolerances required, method of attachment, clearances, and operation.
- C. Samples: Submit two samples, illustrating slat materials and finish, cord type and color.
- D. Manufacturer's Installation Instructions: Indicate special procedures.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Horizontal Louver Blinds Without Side Guides:
 - 1. Hunter Douglas Architectural; Riviera Commercial Aluminum Blinds: www.hunterdouglasarchitectural.com/#sle.
 - 2. Levolor; Riviera Complete Blinds: www.commercial.levolor.com.
 - 3. Substitutions: See Section 016000 - Product Requirements.

2.02 BLINDS

- A. Description: Horizontal slat louvers hung from full-width headrail with full-width bottom rail.
- B. Manual Operation: Cordless control of raising and lowering by with full range locking; blade angle adjustable by control wand.
- C. Metal Slats: Spring tempered pre-finished aluminum; square slat corners, with manufacturing burrs removed.
 - 1. Collection: Custom Riviera
 - 2. Width: 2 inch (50 mm).
 - 3. Color: Ivory 00201.
- 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.
- F. Headrail Attachment: Ceiling brackets.

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2.03 FABRICATION

- A. Determine sizes by field measurement.
- B. Fabricate blinds to cover window frames completely.
- C. At openings requiring multiple blind units, provide separate blind assemblies with space of 1/8 inch (____ mm) between blinds, located at window mullion centers.

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 061000.

3.02 INSTALLATION

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

3.03 TOLERANCES

- A. 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

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SECTION 123200 MANUFACTURED WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manufactured standard and custom casework, with cabinet hardware.

1.02 RELATED REQUIREMENTS

- A. Section 061000 - Rough Carpentry: Blocking and nailers for anchoring casework.
- B. Section 079200 - Joint Sealants: Sealing joints between casework and countertops and adjacent walls, floors, and ceilings.
- C. Section 123600 - Countertops: Additional requirements for countertops.

1.03 DEFINITIONS

- A. Exposed: Portions of casework visible when drawers and cabinet doors are closed, including end panels, bottoms of cases more than 42 inches (1.066 m) above finished floor, tops of cases less than 72 inches (1.82 m) above finished floor and all members visible in open cases or behind glass doors.
- B. Semi-Exposed: Portions of casework and surfaces behind solid doors, tops of cases more than 72 inches (1.828 m) above finished floor and bottoms of cabinets more than 30 inches (0.762 m) but less than 42 inches (1.066 m) above finished floor.
- C. Concealed: Sleepers, web frames, dust panels and other surfaces not generally visible after installation and cabinets less than 30 inches (762 mm) above finished floor.

1.04 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
- D. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
- B. Keying Conference: Conduct conference prior to ordering keys. Incorporate conference decisions into keying submittal.

1.06 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate casework types, sizes, and locations, using large scale plans, elevations, and cross sections. Include rough-in and anchors and reinforcements, placement dimensions and tolerances, clearances required, and keying information.
- C. Verification Samples: Plastic laminate samples for verification, 2 x 3 inches in size.
- D. Maintenance Data: Manufacturer's recommendations for care and cleaning.
- E. Finish touch-up kit for each type and color of materials provided.

1.07 QUALITY ASSURANCE

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

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect items provided by this section, including finished surfaces and hardware items during handling and installation. For metal surfaces, use polyethylene film or other protective material standard with the

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manufacturer.

- B. Acceptance at Site:
 - 1. Do not deliver or install casework until the conditions specified under Part 3, Examination Article of this section have been met. Products delivered to sites that are not enclosed and/or improperly conditioned will not be accepted if warping or damage due to unsatisfactory conditions occurs.
- C. Storage:
 - 1. Store casework in the area of installation. If necessary, prior to installation, temporarily store in another area, meeting the environmental requirements specified under Part 3, "Site Verification of Conditions" Article of this section.

1.09 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion, at no additional cost to Owner. Defects include, but are not limited to:
 - 1. Ruptured, cracked, or stained finish coating.
 - 2. Discoloration or lack of finish integrity.
 - 3. Cracking or peeling of finish.
 - 4. Failure of hardware.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Plastic Laminate Casework:
 - 1. Case Systems: www.casesystems.com/#sle.
 - 2. Osburn Cabinets and Design; www.osburncabinets.com
 - 3. Custom Fabricated.
 - 4. Substitutions: See Section 016000 - Product Requirements.

2.02 CASEWORK, GENERAL

- A. Quality Standard: AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Plastic Laminate Faced Cabinets: Custom Grade.

2.03 FABRICATION

- A. Assembly: Shop assemble casework items for delivery to site in units easily handled and to permit passage through building openings.
- B. Construction: As required for selected grade.
- C. Structural Performance: Safely support the following minimum loads:
 - 1. Base Units: 500 pounds per linear foot (744 kgs/linear m) across the cabinet ends.
 - 2. Suspended Units: 300 pounds (136 kg) static load.
 - 3. Drawers: 125 pounds (57 kg), minimum.
 - 4. Hanging Wall Cases: 300 pounds (135 kg).
 - 5. Shelves: 100 pounds (45 kg), minimum.
- D. Fittings and Fixture Locations: Cut and drill components for fittings and fixtures.
- E. Hardware Application: Factory-machine casework members for hardware that is not surface applied.
- F. Fixed panels at backs of open spaces between base cabinets.
- G. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- H. Scribes and Fillers: Panels of matching construction and finish, for locations where cabinets do not fit tight to adjacent construction.

2.04 PLASTIC-LAMINATE-CLAD CASEWORK

- A. Plastic-Laminate-Clad Casework: Solid wood and wood panel construction; each unit self-contained and not dependent on adjacent units or building structure for rigidity; in sizes necessary to avoid field cutting except for scribes and filler panels. Include adjustable levelers for base cabinets.
 - 1. Style: Flush overlay. Ease doors and drawer fronts slightly at edges.

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2. Cabinet Nominal Dimensions: Unless otherwise indicated, provide cabinets of widths and heights indicated on drawings, and with following front-to-back dimensions:
 - a. Base Cabinets: 23 inches.
 - b. Tall Cabinets: 24 inches.
 - c. Wall Cabinets: 12 inches.
3. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline.
 - a. Exposed Interior Surfaces: Thermally fused laminate.
 - 1) Color: White.

2.05 COUNTERTOPS

- A. Countertops: See Section 123600.

2.06 CABINET HARDWARE

- A. Locks: Provide locks on casework drawers and doors where indicated. Lock with 5 pin cylinder and 2 keys per lock.
- B. Swinging Doors: Hinges, pulls, and catches.
 1. Hinges: Concealed, number as required by referenced standards for width, height, and weight of door.
 - a. Concealed Hinges: Installed in cabinet edge, and on door back, bright chromium plated over nickel on base material.
 - 1) European-Style Hinges for Overlay Doors: 170 degree opening angle.
 2. Pulls: Chrome wire pulls, 4 inches (102 mm) wide.
 3. Catches: Magnetic.
- C. Drawers: Pulls and slides.
 1. Pulls: Chrome wire pulls, 4 inches (102 mm) wide.
 2. Slides: Steel, full extension arms, ball bearings; self-closing; capacity to be 150 lbs per pair, minimum.

2.07 MATERIALS

- A. Wood-Based Materials:
 1. Solid Wood: Air-dried to 4.5 percent moisture content, then tempered to 6 percent moisture content before use.
- B. Concealed Solid Wood or Plywood: Any species and without defects affecting strength or utility.
- C. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications, complying with Grade requirements, and standard with the manufacturer.
 1. PLAM-1: Cabinets
 - a. Manufacturer: Formica
 - b. Color/Pattern: 6208-43 Glamour Cherry

2.08 ACCESSORIES

- A. Plastic Edge Banding: Extruded PVC, flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
 1. Color: Match PLAM-1..
 2. Use at exposed edges.
 3. Use at exposed shelf edges.
- B. Concealed Joint Fasteners: Corrosion-resistant, standard with manufacturer.

PART 3 EXECUTION

3.01 PREPARATION

- A. Large Components: Ensure that large components can be moved into final position without damage to other construction.

3.02 EXAMINATION

- A. Site Verification of Environmental Conditions:
 1. Do not deliver casework until the following conditions have been met:
 - a. Building has been enclosed (windows and doors sealed and weather-tight).

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- b. An operational HVAC system that maintains temperature and humidity at occupancy levels has been put in place.
 - c. Ceiling, overhead ductwork, piping, and lighting have been installed.
 - d. Installation areas do not require further "wet work" construction.
- B. For Base Cabinets Installation: Examine floor levelness and flatness of installation space. Do not proceed with installation if encountered floor conditions required more than 1/2 inch (13 mm) leveling adjustment. When installation conditions are acceptable, for each space, establish the high point of the floor. Set and make level and plumb first cabinet in relation to this high point.
- C. For Wall Cabinets Installation: Examine wall surfaces in installation space. Do not proceed with installation if the following conditions are encountered:
- D. Verify adequacy of support framing and anchors.
- E. Verify that service connections are correctly located and of proper characteristics.

3.03 INSTALLATION

- A. Perform installation in accordance with manufacturer's instructions.
- B. Use anchoring devices to suit conditions and substrate materials encountered. Use concealed fasteners to the greatest degree possible. Use exposed fasteners only where allowed by approved shop drawings, or where concealed fasteners are impracticable.
- C. Set casework items plumb and square, securely anchored to building structure.
- D. Align cabinets to adjoining components, install filler and/or scribe panels where necessary to close gaps.
- E. Fasten together cabinets in continuous runs, with joints flush, uniform and tight. Misalignment of adjacent units not to exceed 1/16 inch (1.6 mm). In addition, do not exceed the following tolerances:
- 1. Variation of Tops of Base Cabinets from Level: 1/16 inch (1.6 mm) in 10 feet (3 m).
 - 2. Variation of Faces of Cabinets from a True Plane: 1/8 inch (3 mm) in 10 feet (3 m).
 - 3. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch (0.8 mm).
 - 4. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch (1.6 mm).
- F. Base Cabinets: Fasten cabinets to service space framing and/or wall substrates, with fasteners spaced not more than 16 inches (407 mm) on center. Bolt adjacent cabinets together with joints flush, tight, and uniform.
- G. Install hardware uniformly and precisely.
- H. Countertops: Install countertops intended and furnished for field installation in one true plane, with ends abutting at hairline joints, and no raised edges.
- I. Replace units that are damaged, including those that have damaged finishes.

3.04 ADJUSTING

- A. Adjust operating parts, including doors, drawers, hardware, and fixtures to function smoothly.

3.05 CLEANING

- A. Clean casework and other installed surfaces thoroughly.

3.06 PROTECTION

- A. Do not permit finished casework to be exposed to continued construction activity.
- B. Protect casework and countertops from ongoing construction activities. Prevent workmen from standing on, or storing tools and materials on casework or countertops.
- C. Repair damage, including to finishes, that occurs prior to Date of Substantial Completion, using methods prescribed by manufacturer; replace units that cannot be repaired to like-new condition.

END OF SECTION

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SECTION 123600 COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Countertops for manufactured casework.
- B. Wall-hung counters and vanity tops.

1.02 RELATED REQUIREMENTS

- A. Section 123200 - Manufactured Wood Casework.
- B. Section 224000 - Plumbing Fixtures: Sinks.

1.03 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard; 2022.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
- D. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- E. SEFA 2 - Installations; 2010.

1.04 SUBMITTALS

- A. See Section 013000 - 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. Verification Samples: For each finish product specified, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.
- E. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of experience.

1.06 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.

1.07 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. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
 - 1. Laminate Sheet, Type PLAM-2: NEMA LD 3, Grade HGS, 0.048 inch (1.2 mm) nominal thickness.
 - a. Manufacturer: Formica
 - b. Color/Pattern: 1097-58 Citadel
 - c. Finish: Matte or suede, gloss rating of 5 to 20.

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2. Back and End Splashes: Same material, same construction.

2.02 MATERIALS

- A. Particleboard for Supporting Substrate: ANSI A208.1 Grade 2-M-2, 45 pcf (20 kg/cu m) minimum density; minimum 3/4 inch (19 mm) thick; join lengths using metal splines.
- B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- C. Sealer: Stain and acid protection for natural stone counters.

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.

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. Install laboratory worksurface countertops in compliance with requirements of SEFA 2.
- B. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- C. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch (16 mm).
- 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

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SECTION 144200 WHEELCHAIR LIFTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vertical platform wheelchair lifts.
- B. Maintenance contract.

1.02 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- C. ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices; 2022.
- D. ASME A18.1 - Safety Standard for Platform Lifts and Stairway Chairlifts; 2023.
- E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- F. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021a.
- G. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel; 2021, with Editorial Revision.
- H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- I. ASTM A786/A786M - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates; 2015 (Reapproved 2021).
- J. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2020.
- K. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- L. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018, with Errata (2022).
- M. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- N. ITS (DIR) - Directory of Listed Products; Current Edition.
- O. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- P. UL (DIR) - Online Certifications Directory; Current Edition.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate installation of wheelchair lift system with adjacent construction using necessary attachments; provide anchoring devices in accordance with manufacturer's installation instructions.
 - 1. Electrical System: Coordinate utility and electrical system connections to ensure they are made in an orderly and expeditious manner.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Include data on material descriptions, construction details, component dimensions and profiles, and finishes; include data on rated capacities, electrical and operating characteristics, and necessary accessories.
- C. Shop Drawings: Include plans, elevations, sections, and attachment details; include equipment assembly details with dimensions, weights, loads, required clearances, components, size and location of anchors and required field connections, and methods for field assembly; provide diagrams indicating signal, power, and control wiring.
- D. Manufacturer's qualification statement.
- E. Maintenance contracts.

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- F. Executed warranty.
- G. Project Record Documents: Accurately record actual locations of concealed items, conduits, and components.
- H. Maintenance Materials: Provide the following for Owner's use in maintenance of wheelchair lifts and equipment.
 - 1. See Section 016000 - Product Requirements for additional provisions.
 - 2. Provide technical information for servicing operating equipment.
 - 3. Spare Parts: Provide parts catalog with complete list of equipment replacement parts; identify each entry with equipment description and identifying code.
 - 4. Provide legible schematic wiring diagrams of installed electrical equipment and changes made to this part of work; list symbols corresponding to identity or markings on wheelchair lifts structural and electrical components.

1.05 QUALITY ASSURANCE

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

1.06 FIELD CONDITIONS

- A. Use of wheelchair lifts during construction for hoisting materials or personnel is not permitted.

1.07 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 2-year manufacturer warranty to repair or replace wheelchair lift system components that fail in materials or workmanship. Complete forms in Owner's name and register with manufacturer.
- C. Extended Correction Period: Correct defective work within 2-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with ASME A18.1, ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).
- B. Accessibility Requirements: Comply with ADA Standards and ICC A117.1.
- C. Structural Performance: Comply with ASCE 7 for loading of wheelchair lift components and assemblies.
- D. Perform welding of steel in accordance with AWS D1.1/D1.1M.
- E. Perform electrical work in accordance with NFPA 70.

2.02 VERTICAL PLATFORM WHEELCHAIR LIFTS

- A. Manufacturers:
 - 1. Basis of Design: Ameriglide Accessibility Solutions: Hercules 750 Commercial; www.ameriglide.com
 - 2. Other Acceptable Manufacturers: Provide either product listed as "Basis of Design" or an equivalent product from one of the manufacturers listed below.
 - a. Butler Mobility Products: www.butlermobility.com/#sle.
 - b. Garaventa Lift: www.garaventalift.com/#sle.
 - 3. Substitutions: See Section 016000 - Product Requirements.
- B. Vertical Platform Wheelchair Lifts: Provide manufacturer's standard type that complies with indicated requirements. Use manufacturer's standard components for vertical platform wheelchair lifts as required for complete system unless otherwise indicated.
 - 1. Type of Vertical Platform Wheelchair Lift:
 - a. Vertical platform wheelchair lift without shaftway or enclosure; platform includes sidewalls and gate creating safety barrier for passenger.
 - 2. Configuration:
 - a. 90-degree turn entry/exit, with front and side openings.
 - b. Number of Stops: Two.
 - c. Landing Openings, Self-Closing:
 - 1) Lower landing with platform-mounted gate.

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- 2) Upper landing with gate and platform mounted gate.
3. Location:
 - a. Interior of building, as indicated on drawings.
4. Lift Load Capacity: 750 lb (340 kg), maximum.
5. Lifting Height from Bottom to Upper Floor Level: As indicated on drawings.
6. Platform Width Clearance: 36 inches (914 mm).
7. Platform Length Clearance: 54 inches (1371 mm).
8. Platform Gate: Self-closing and flush-mounted, nominal height of 42 inches (1067 mm) with width corresponding to width of platform.
9. Platform Side Wall Panels: Nominal height of 42 inches (1067 mm), with galvanized steel sheet panels, and enclosed within rectangular extruded aluminum framework.
10. Platform Floor: Galvanized steel sheet with matte finish, having overall thickness not greater than 1-1/2 inches (38 mm).
11. Access Ramp at Bottom Landing: Fixed ramp to transition from floor level to lift platform, with ramp finish to match lift platform.
 - a. Size: Provide end ramps at least 32 inches (813 mm) wide and side ramps at least 42 inches (1067 mm) wide; length as required for slope with 1:12 maximum slope.
12. Drive System:
 - a. Self-lubricating acme screw drive.
 - 1) Rated Speed: 12 fpm (3.7 m/min), nominal.
13. Drive System Enclosure: Provide rectangular galvanized steel tube frame with flush steel sheet panels on sides and top to enclose drive system components; securely attach enclosure to adjacent substrate.

2.03 ELECTRICAL CHARACTERISTICS AND COMPONENTS

- A. Electrical Characteristics:
 1. 1 HP.
 2. 110 VAC, single-phase, 60 Hz.
- B. Platform Controls: Continuous pressure switch, one for each direction, with keyless operation.
- C. Emergency Operation: Provide manual operation and battery-powered system to raise or lower lift to landing due to malfunction or loss of power.
- D. Electrical Components, Boxes, Conduit, Wiring, and Devices: Comply with NFPA 70 and UL (DIR) or ITS (DIR) listed and labeled, and marked as applicable for proposed locations.

2.04 MATERIALS

- A. Rolled Steel Sections, Shapes, and Rods: Comply with ASTM A36/A36M.
- B. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, Designation SS (structural steel), Grade 33 (230), with G90/Z275 coating.
- C. Rolled Steel Floor Plates: Comply with ASTM A786/A786M, 1/8 inch (3.2 mm) thick, with manufacturer's standard surface pattern; rolled from steel plate complying with ASTM A572/A572M, Grade 55 (380).
- D. Steel Tubing: Comply with ASTM A500/A500M, cold formed.
- E. Anchor Bolts and Rods: Comply with ASTM F1554, Grade 55.
- F. Welding: Comply with applicable requirements of AWS D1.1/D1.1M and AWS D1.3/D1.3M.

2.05 EQUIPMENT

- A. Lubrication of Equipment: Provide grease fittings for lubricating bearings requiring periodic lubrication, automatic feed type grease cups, and visible and easily accessible lubrication points.
- B. Guide Rails, Ropes, Counterweights, Sheaves, Attachment Brackets, and Anchors: Sized in accordance with local building code, including safety factors.
- C. Maintenance Devices: Provide as necessary within wheelchair lift system, supported on structural members within accessible locations.

2.06 FINISHES

- A. Baked-On Factory Finish for Structural Metal Surfaces: Clean surfaces of rust, oil, or grease and wipe clean with solvent; apply manufacturer's standard two-coat, baked-on finish consisting of primer and thermosetting top coat.
 1. Color: Custom RAL Color - TBD.

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PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that areas and conditions comply with installation tolerances and other conditions affecting this work.
- B. Verify that locations for electrical rough-in connections to system equipment are in acceptable locations before installing equipment.
- C. Verify that electrical power is available and of correct characteristics.
- D. Do not proceed with installation until unacceptable conditions have been corrected.

3.02 PREPARATION

- A. Prepare surfaces of substrates using methods in accordance with lift manufacturer's installation instructions.
- B. Clean surfaces thoroughly before starting installation of lifts.

3.03 INSTALLATION

- A. Install wheelchair lift system and components in accordance with manufacturer's written installation instructions.
- B. Install wheelchair lift system securely to supporting structure, and flush with adjacent surfaces.
- C. Install structural components using methods that comply with requirements indicated relative to layout and structural position.

3.04 ADJUSTING

- A. Adjust wheelchair lift equipment to operate smoothly and safely.
- B. Verify vertical travel of wheelchair lift system; adjust as necessary to maintain operating range indicated.
- C. After installation, inspect exposed factory-finished wheelchair lift equipment and repair damaged finishes.

3.05 CLEANING

- A. See Section 017000 - Execution and Closeout Requirements for additional requirements.
- B. Remove protective coverings from finished surfaces.
- C. Clean surfaces and components.

3.06 CLOSEOUT ACTIVITIES

- A. See Section 017800 - Closeout Submittals for closeout submittals.
- B. See Section 017900 - Demonstration and Training for additional requirements.
- C. Demonstrate proper operation of wheelchair lifts 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.

3.07 MAINTENANCE

- A. See Section 017000 - Execution and Closeout Requirements for additional requirements.
- B. Provide a separate maintenance contract for service and maintenance of wheelchair lifts system and components for one year after Date of Substantial Completion.
- C. Perform maintenance work using competent personnel under supervision and in direct employment of wheelchair lift installer.
- D. Examine monthly; clean, adjust, and lubricate equipment.
- E. Repair, or replace parts when required with parts produced by original equipment manufacturer.

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F. Provide emergency call back service 24 hours per day during maintenance period.

END OF SECTION

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SECTION 210500 COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Above ground piping.
- B. Buried piping.
- C. Escutcheons.
- D. Expansions - hose and braid.
- E. Fire rated enclosures.
- F. Mechanical couplings.
- G. Pipe hangers and supports.
- H. Pipe sleeves.
- I. Pipe sleeve-seal systems.
- J. Retrofit-sprinkler piping cover system.

1.02 RELATED REQUIREMENTS

- A. Section 07 84 00 - Firestopping.
- B. Section 21 12 00 - Fire-Suppression Standpipes: Standpipe design.
- C. Section 21 13 00 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information. Indicate valve data and ratings.
- C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, and floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.
- D. Manufacturer's qualification statement.
- E. Installer's qualification statement.
- F. Project Record Documents: Record actual locations of components and tag numbering.
- G. Operation and Maintenance Data: Include installation instructions and spare parts lists.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section.
 - 1. Minimum three years experience.
- C. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.
- D. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.05 DELIVERY, STORAGE, AND HANDLING

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

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

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- B. Correct defective Work within a five year period after Date of Substantial Completion.

1.07 REFERENCE STANDARDS

- A. ASME A112.18.1 - Plumbing Supply Fittings; 2018, with Errata.
- B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.
- C. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.
- D. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2021.
- E. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.
- F. ASME B16.9 - Factory-Made Wrought Butt welding Fittings; 2018.
- G. ASME B16.11 - Forged Fittings, Socket-Welding and Threaded; 2021.
- H. ASME B16.25 - Butt welding Ends; 2022.
- I. ASME B36.10M - Welded and Seamless Wrought Steel Pipe; 2022.
- J. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.
- K. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).
- L. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
- M. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2021.
- N. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.
- O. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).
- P. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2021.
- Q. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2022a.
- R. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- S. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.
- T. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- U. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.
- V. AWWA C606 - Grooved and Shouldered Joints; 2022.
- W. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- X. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; 2024.
- Y. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Standpipe and Hose System:
 - 1. Comply with NFPA 14.
 - 2. See Section 21 12 00.
- B. Welding Materials and Procedures: Comply with ASME BPVC-IX.
- C. Provide system pipes, fittings, sleeves, escutcheons, seals, and other related accessories.

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2.02 BURIED PIPING

- A. Steel Pipe: ASTM A53/A53M Schedule 40, ASTM A135/A135M Schedule 10, ASTM A795/A795M Standard Weight, or ASME B36.10M Schedule 40, black, with AWWA C105/A21.5 polyethylene jacket, or double layer, half-lapped polyethylene tape.
 - 1. Steel Fittings: ASME B16.9, wrought steel, butt welded, ASME B16.25, butt weld ends, ASTM A234/A234M, wrought carbon steel or alloy steel, ASME B16.5, steel flanges and fittings, or ASME B16.11, forged steel socket welded and threaded; with double layer, half-lapped polyethylene tape.
 - 2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings.
 - 3. Joints: Welded in accordance with AWS D1.1/D1.1M.
 - 4. Casing: Closed glass cell insulation.

2.03 ABOVE GROUND PIPING

- A. Steel Pipe: ASTM A53/A53M Schedule 40, ASTM A135/A135M Schedule 10, ASTM A795/A795M Standard Weight or ASME B36.10M Schedule 40, black.
 - 1. Steel Fittings: ASME B16.9, wrought steel, butt welded, ASME B16.25, butt weld ends, ASTM A234/A234M, wrought carbon steel or alloy steel, ASME B16.5, steel flanges and fittings or ASME B16.11, forged steel socket welded and threaded; with double layer, half-lapped polyethylene tape.
 - 2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.
 - 3. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M.
 - 4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
 - 5. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement onto pipe.

2.04 PIPE SLEEVES

- A. Vertical Piping:
 - 1. Sleeve Length: 1 inch above finished floor.
 - 2. Provide sealant for watertight joint.
 - 3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
 - 4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.
- B. Plastic, Sheet Metal, or Moisture-Resistant Fiber: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.
- C. Pipe Passing Through Below Grade Exterior Walls:
 - 1. Zinc-coated or cast-iron pipe.
 - 2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.
- D. Pipe Passing Through Quarry Tile, Terrazzo, or Ceramic Tile Floors:
 - 1. Brass pipe.
 - 2. Connect sleeve with floor plate.
- E. Pipe Passing Through Concrete Beam Flanges, except where Brass Pipe Sleeves are Specified:
 - 1. Galvanized steel pipe or black iron pipe with asphalt coating.
 - 2. Connect sleeve with floor plate except in mechanical rooms.
- F. Not required for wall hydrants for fire department connections or in drywall construction.
- G. Penetrations in concrete beam flanges are permitted but are prohibited through ribs or beams without prior approval from the Architect.
- H. Clearances:
 - 1. Provide allowance for insulated piping.
 - 2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
 - 3. Rated Openings: Caulked tight with firestopping material complying with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.

2.05 PIPE SLEEVE-SEAL SYSTEMS

- A. Modular Mechanical Seals:
 - 1. Elastomer-based interlocking links to continuously fill annular space between pipe and wall-sleeve, wall or casing opening.

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2. Watertight seal between pipe and wall-sleeve, wall or casing opening.
 3. Size and select seal component materials in accordance with service requirements.
 4. Service Requirements:
 - a. Underground, buried, and wet conditions.
 5. Glass-reinforced plastic pressure end plates.
- B. Wall Sleeve: PVC material with waterstop collar, and nailer end caps.
- C. Sleeve-Forming Disk: Nonconductive plastic-based material, 3 inch thick.
- D. Pipeline-Casing Seals:
 1. End Seals: 1/8 inch, pull-on type, rubber or synthetic rubber based.

2.06 FIRE-RATED ENCLOSURES

- A. Provide as required to preserve fire resistance rating of building elements.

2.07 ESCUTCHEONS

- A. Material:
 1. Fabricate from nonferrous metal.
 2. Chrome-plated.
 3. Metals and Finish: Comply with ASME A112.18.1.
- B. Construction:
 1. One-piece for mounting on chrome-plated tubing or pipe and one-piece or split-pattern type elsewhere.
 2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

2.08 PIPE HANGERS AND SUPPORTS

- A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
- B. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.
- C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- D. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.
- E. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.
- F. Vertical Support: Steel riser clamp.
- G. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- H. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- I. Seismic Hangers and Couplings:
 1. Provide coupling with a factory set disengagement rating of 140 percent to 160 percent of the static weight.
 2. Provide resettable and reusable, break away couplings.
 3. Provide tether cables to avoid excessive seismic joint movement.
 4. Coupling to be manufactured from non-corrosive materials.

2.09 EXPANSION JOINTS AND LOOPS - HOSE AND BRAID

- A. Provide flexible loops with two flexible sections of hose and braid, two 90-degree elbows, and 180-degree return with support bracket and air release or drain plug.
- B. Provide flexible loops capable of movement in the x, y, and z planes. Flexible loops to impart no thrust loads to the building structure.
- C. Flexible Connectors: Flanged, braided type with wetted components of stainless steel, sized to match piping.
 1. Maximum Allowable Working Pressure: 150 psig at 120 degrees F.
 2. Accommodate the Following:
 - a. Axial Deflection in Compression and Expansion: 6 inch.
 - b. Lateral Movement: 2 inch.
 - c. Angular Rotation: 15 degrees.
 - d. Force developed by 1.5 times specified maximum allowable operating pressure.
 3. Provide necessary accessories including, but not limited to, swivel joints.

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2.10 MECHANICAL COUPLINGS

- A. Rigid Mechanical Couplings for Grooved Joints:
 - 1. Dimensions and Testing: Comply with AWWA C606.
 - 2. Minimum Working Pressure: 300 psig.
 - 3. Housing Material: Fabricate of ductile iron complying with ASTM A536.
 - 4. Housing Coating: Factory applied orange enamel.
 - 5. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
 - 6. Bolts and Nuts: Hot-dipped-galvanized or zinc-electroplated steel.

2.11 RETROFIT-SPRINKLER PIPING COVER SYSTEM

- A. General Requirements:
 - 1. Surface Burning Characteristics: Flame spread index/smoke developed index of 20/250, maximum, when tested in accordance with ASTM E84 or UL 723.
- B. Materials:
 - 1. Piping Cover System: Removal-resistant, modular, snap-fit cover units, clips, and anchors for use with CPVC, steel, and copper piping systems.

PART 3 EXECUTION

3.01 COVER UNITS: L-SHAPED AND U-SHAPED CROSS-SECTION UNITS OF FLAME RETARDANT RESIN MATERIAL, PAINTABLE FINISH.

- 1. Unit Length: 7.5 feet.
- 2. Provide sidewall sprinkler head housing in compliance with NFPA 13.
- 3. Provide coupling fittings for joining units end to end and prefabricated inside and outside corner fittings and end caps as required.
- 4. Provide mounting clips to secure covers to wall-ceiling per manufacturer requirements.

3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

- A. Install standpipe piping, hangers, and supports in accordance with NFPA 14.
- B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- C. Install piping to conserve building space, to not interfere with use of space and other work.
- D. Group piping whenever practical at common elevations.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. 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.
- G. Pipe Hangers and Supports:
 - 1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 - 2. Place hangers within 12 inches of each horizontal elbow.
 - 3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.

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5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 6. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- H. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
- I. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.
- J. Structural Considerations:
1. Do not penetrate building structural members unless indicated.
- K. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
 2. Aboveground Piping:
 - a. Pack solid using mineral fiber complying with ASTM C592.
 - b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
 3. All Rated Openings: Caulk tight with firestopping material complying with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.
 4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.
- L. Manufactured 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.
- M. Escutcheons:
1. Install and firmly attach escutcheons at piping penetrations into finished spaces.
 2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.
 3. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.
- N. 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, unions, and couplings for servicing are consistently provided.
- O. Die-cut threaded joints with full-cut, standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.

3.04 CLEANING

- A. Upon completion of work, clean all parts of the installation.
- B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION

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SECTION 211300 FIRE SUPPRESSION SPRINKLER SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wet-pipe sprinkler system.
- B. Dry-pipe sprinkler system.
- C. Deluge sprinkler system.
- D. Preaction sprinkler system.
- E. System design, installation, and certification.
- F. Fire department connections.

1.02 REFERENCE STANDARDS

- A. FM (AG) - FM Approval Guide; Current Edition.
- B. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2018, with Editorial Revision (2020).
- C. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry; 2018, with Editorial Revision (2020).
- D. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2017, with Editorial Revision (2020).
- E. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2023.
- F. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. NFPA 1963 - Standard for Fire Hose Connections; 2019.
- H. UL (DIR) - Online Certifications Directory; Current Edition.
- I. UL 405 - Standard for Safety Fire Department Connection Devices; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. 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 Architect.
- D. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.
- E. Designer's qualification statement.
- F. Manufacturer's qualification statement.
- G. Installer's qualification statement.

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- H. 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.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements for additional provisions.
 - 2. Extra Sprinklers: Type and size matching those installed in quantity required by referenced NFPA design and installation standard.
 - 3. Sprinkler Wrenches: For each sprinkler type.
- J. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

1.05 QUALITY ASSURANCE

- A. Comply with FM (AG) requirements.
- B. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- 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 3 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.

1.06 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. Tyco Fire Protection Products: www.tyco-fire.com/#sle.
 - 2. Viking Corporation: www.vikinggroupinc.com/#sle.
 - 3. Substitutions: See Section 01 60 00 - 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. Interface system with building control system.
- E. Provide fire department connections where indicated.
- F. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.
- G. Pipe Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
 - 1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
 - 2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
 - 3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
 - 4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
 - 5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
 - 6. Other Types: As required.

2.03 SPRINKLERS

- A. Suspended Ceiling Type: Concealed pendant type with matching push on escutcheon plate.
 - 1. Response Type: Quick.

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2. Coverage Type: Standard.
 3. Finish: Brass.
 4. Escutcheon Plate Finish: Chrome plated.
 5. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
- B. Exposed Area Type: Pendant type with guard.
1. Response Type: Quick.
 2. Coverage Type: Standard.
 3. Finish: Brass.
 4. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
- C. Sidewall Type: Semi-recessed horizontal sidewall type with matching push on escutcheon plate.
1. Response Type: Quick.
 2. Coverage Type: Standard.
 3. Finish: Chrome plated.
 4. Escutcheon Plate Finish: Chrome plated.
 5. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
- D. Dry Sprinklers: Concealed pendant type with matching push on escutcheon plate.
1. Response Type: Quick.
 2. Coverage Type: Standard.
 3. Finish: Brass.
 4. Cover Plate Finish: Brass.
 5. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
- E. Residential Sprinklers: Concealed upright type with matching push on escutcheon plate.
1. Response Type: Quick.
 2. Finish: Brass.
 3. Cover Plate Finish: Antique Brass.
 4. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
- F. Storage Sprinklers: Pendant type with guard.
1. Response Type: Standard.
 2. Coverage Type: Standard.
 3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
- G. Guards: Finish to match sprinkler finish.
- H. Spray Nozzles: Brass with solid cone discharge, 30 degrees of arc with blow-off dust cap.
1. Finish: Brass.
- I. 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:

2.04 PIPING SPECIALTIES

- A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber-faced clapper to automatically actuate water motor alarm, pressure retard chamber and variable pressure trim with the following additional capabilities and features:
1. Activate electric alarm.
 2. Test and drain valve.
 3. Replaceable internal components without removing valve from installed position.
- B. Dry Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm, accelerator, and with the following additional capabilities and features:
1. Activate electric alarm.
 2. Test and drain valve.
 3. Externally resettable.
 4. Replaceable internal components without removing valve from installed position.
- C. Flooding Deluge Valve: Gate type valve with rubber faced disc actuated manually with water motor alarm and electric alarm, with alarm testing trim.
- D. Preaction Valve:

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1. Operated by detection system listed for releasing service and independent of building fire alarm system with provisions for local, manual, and indicated remote releases.
 2. Incorporate mechanical latching mechanism incorporating valve clappers independent of system water pressure fluctuations.
 3. Provide test detection device for each actuation circuit adjacent to each controlled valve in accordance with NFPA 13.
- E. Backflow Preventer: Double check valve assembly backflow preventer with drain and OS & Y gate valve on each end.
- F. 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 05 53.
- G. Water Motor Alarm: Hydraulically operated impeller type alarm with aluminum alloy chrome plated gong and motor housing, nylon bearings, and inlet strainer.
- H. Electric Alarm: Electrically operated chrome plated gong with pressure alarm switch.
- I. 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.
- J. Fire Department Connections:
1. Type: Exposed, projected 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. Rated Working Pressure: 175 psi.
 - c. Finish: Polished brass.
 - d. Signage: Raised or engraved lettering 1 inch minimum indicating system type.

2.05 PREACTION VALVE CONTROL PANEL

- A. Provide a modular type control panel for electrically operated detection and extinguishing systems for each preaction valve.
1. Factory mount in surface mounted, steel cabinet with hinged doors, and cylinder lock.
 2. Provide factory wired assembly containing components and equipment as required to perform specified system operating and supervisory functions.
 3. Include isolation switch to allow system testing without activation of the preaction valve.
 4. House batteries in separate and lockable, steel cabinet.
 5. Finish interior and exterior of cabinet with enamel paint and provide identification plates in accordance with Section 21 05 53.
 6. Include trouble lights and trouble alarm.
 7. Provide 120 volt AC service transformed through a two-winding, isolation type transformer and rectified to low voltage DC for operation of all system actuating, signal sounding, trouble signal, and fire alarm tripping circuits.
 8. Provide UL (DIR) listed as an extinguishing system releasing panel and separate from the building's fire alarm control panel.
- B. Secondary Power Supply:
1. Provide nickel cadmium, lead calcium, or sealed lead acid rechargeable storage batteries and battery charger.
 2. Storage Batteries:
 - a. Provide with sufficient ampere-hour rating to operate under supervisory and trouble conditions, including audible trouble signal devices under alarm conditions for an additional 10 minutes and as required in accordance with the equipment listing.

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- b. Prevent contact between terminals of adjacent cells, battery terminals, and other metal parts with separate cell construction.
- 3. Battery Charger:
 - a. Provide solid-state automatic two rate type, capable of recharging completely discharged batteries to fully charged condition in 24 hours or less.
 - b. Locate charger within control panel or battery cabinet.
- C. Wiring: Refer to Section 26 05 83.

2.06 AIR COMPRESSOR

- A. Compressor: Single-unit, electric motor driven, motor, motor starter, safety valves, check valves, air maintenance device incorporating electric pressure switch and unloader valve.

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 double check valve 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. Locate outside alarm gong on building wall as indicated.
- F. Place pipe runs to minimize obstruction to other work.
- G. Place piping in concealed spaces above finished ceilings.
- H. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.
- I. 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.
- J. Flush entire piping system of foreign matter.
- K. Install guards on sprinklers where indicated.
- L. Hydrostatically test entire system.
- M. 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

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SECTION 220513 COMMON MOTOR REQUIREMENTS FOR PLUMBING 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. NEMA MG 1 - Motors and Generators; 2021.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.
- C. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.
- D. Operation Data: Include instructions for safe operating procedures.
- E. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.04 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.

1.05 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Baldor Electric Company/ABB Group: www.baldor.com/#sle.
- B. Leeson Electric Corporation: www.leeson.com/#sle.
- C. Regal-Beloit Corporation (Century): www.centuryelectricmotor.com/#sle.
- D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 GENERAL CONSTRUCTION AND REQUIREMENTS

- A. 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 1 limits for insulation class, service factor, and motor enclosure type.
- B. Explosion-Proof Motors: UL approved and labelled for hazard classification, with over temperature protection.

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- 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. Single phase motors for shaft mounted fans, oil burners, and centrifugal pumps: Split phase type.
- C. Single phase motors for shaft mounted fans or blowers: Permanent split capacitor type.
- D. Single phase motors for fans, pumps, blowers, and air compressors: Capacitor start type.
- E. Single phase motors for fans, blowers, and pumps: Capacitor start, capacitor run type.
- F. Motors located in exterior locations, wet air streams downstream of sprayed coil dehumidifiers, draw through cooling towers, air cooled condensers, humidifiers, direct drive axial fans, roll filters, explosion proof environments, and dust collection systems: Totally enclosed type.
- G. 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.
- H. Motors located outdoors and in draw through cooling towers: Totally enclosed weatherproof epoxy-sealed type.

2.04 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.

2.05 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

- A. Starting Torque: Exceeding one fourth of full load torque.
- B. Starting Current: Up to six times full load current.
- C. Multiple Speed: Through tapped windings.
- D. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

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. Pull-up Torque: Up to 350 percent of full load torque.
- D. Breakdown Torque: Approximately 250 percent of full load torque.
- E. 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.
- F. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.

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- G. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.07 ELECTRONICALLY COMMUTATED MOTORS (ECM)

- A. Manufacturers:
 - 1. US Motors, a brand of NIDEC Motor Corporation: www.usmotors.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

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

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SECTION 220516 EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flexible pipe connectors.
- B. Expansion joints and compensators.
- C. Pipe loops, offsets, and swing joints.

1.02 RELATED REQUIREMENTS

- A. Section 22 10 05 - Plumbing Piping.

1.03 REFERENCE STANDARDS

- A. EJMA (STDS) - EJMA Standards; Tenth Edition.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data:
 - 1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
 - 2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
- C. Manufacturer's Instructions: Indicate manufacturer's installation instructions, special procedures, and external controls.
- D. Maintenance Data: Include adjustment instructions.
- E. Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements for additional provisions.
 - 2. Extra Packing for Packed Expansion Joints: One set for each joint.

PART 2 PRODUCTS

2.01 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

- A. Manufacturers:
 - 1. Mercer Rubber Company: www.mercer-rubber.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Inner Hose: Stainless steel.
- C. Exterior Sleeve: Single braided, stainless steel.
- D. Pressure Rating: 125 psi up to 12 inch.
- E. End Connections: Threaded.
- F. Size: Use pipe sized units.
- G. Maximum offset: 3/4 inch on each side of installed center line.

2.02 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

- A. Manufacturers:
 - 1. Mercer Rubber Company: www.mercer-rubber.com/#sle.
 - 2. The Metraflex Company: www.metraflex.com/#sle.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Inner Hose: Bronze.

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- C. Exterior Sleeve: Braided bronze.
- D. Pressure Rating: ____ psi up to ____ inch.
- E. End Connections: Flanged.
- F. Size: Use pipe sized units.
- G. Maximum offset: 3/4 inch on each side of installed center line.
- H. Application: Copper piping.

2.03 EXPANSION JOINTS - STAINLESS STEEL BELLOWS TYPE

- A. Manufacturers:
 - 1. Mercer Rubber Company: www.mercer-rubber.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Pressure Rating: 125 psi and 400 degrees F.
- C. Maximum Compression: 1-3/4 inches.
- D. Maximum Extension: 1/4 inch.
- E. Joint Type: Externally pressurized with flanged ends.
- F. Size: Use pipe sized units.
- G. Application: Steel piping 4 inches and under.

2.04 EXPANSION JOINTS - TWO-PLY BRONZE BELLOWS TYPE

- A. Manufacturers:
 - 1. Mercer Rubber Company: www.mercer-rubber.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Construction: Bronze with anti-torque device, limit stops, internal guides.
- C. Pressure Rating: 125 psi and 400 degrees F.
- D. Maximum Compression: 1-3/4 inches.
- E. Maximum Extension: 1/4 inch.
- F. Joint: Soldered.
- G. Size: Use pipe sized units.
- H. Application: Copper piping.

2.05 EXPANSION LOOPS - HOSE AND BRAID

- A. Manufacturers:
 - 1. The Metraflex Company; Metraloop: www.metraflex.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Provide flexible loops with two flexible sections of hose and braid, two 90 degree elbows, and 180 degree return with support brackets and plugged drain port for steam service.
- C. Maximum Allowable Motion: 2 inch in the x, y, and z planes with no thrust loads to the building structure.
- D. Maximum Working Pressure: 150 psi at 800 degrees F.
- E. Construction: Class 150, schedule 40, stainless steel hose and braid assembly with carbon steel fittings, including elbows and flanged end connections sized to match pipe segment.
 - 1. Selected Product to Accommodate:
 - a. Axial Deflection in Compression and Expansion: 1 inch.
 - b. Angular Rotation: 15 degrees.
 - c. Force developed by 1.5 times specified maximum allowable operating pressure.
 - 2. Provide necessary accessories including, but not limited to, swivel joints.

2.06 ACCESSORIES

- A. Pipe Alignment Guides:
 - 1. Manufacturers:

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- a. The Metraflex Company; PGQ Glide Riser Guide: www.metraflex.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 2. Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inches travel.
- B. Swivel Joints:
1. Fabricated steel body, double ball bearing race, field lubricated, with rubber (Buna-N) o-ring seals.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with EJMA (Expansion Joint Manufacturers Association) Standards.
- C. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.
- D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.
- E. Anchor pipe to building structure where indicated. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.
- F. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.
- G. Substitute grooved piping for vibration isolated equipment instead of flexible connectors. Grooved piping need not be anchored.

END OF SECTION

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SECTION 220517 SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe sleeves.
- B. Pipe sleeve-seals.

1.02 REFERENCE STANDARDS

- A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2022a.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.
- B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

- A. Manufacturers:
 - 1. Flexicraft Industries; Pipe Wall Sleeve: www.flexicraft.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Vertical Piping:
 - 1. Sleeve Length: 1 inch above finished floor.
 - 2. Provide sealant for watertight joint.
- C. Plastic or Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.
- D. Pipe Passing Through Below Grade Exterior Walls:
 - 1. Zinc coated or cast iron pipe.
 - 2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.
- E. Pipe Passing Through Concrete Beam Flanges, except where Brass Pipe Sleeves are Specified:
 - 1. Galvanized steel pipe or black iron pipe with asphalt coating.
 - 2. Connect sleeve with floor plate except in mechanical rooms.
- F. Penetrations in concrete beam flanges are permitted but are prohibited through ribs or beams without prior approval from the Architect.

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- G. Clearances:
1. Provide allowance for insulated piping.
 2. Wall, Floor, Partitions, and Beam Flanges: 1 inch greater than external pipe diameter.
 3. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.

2.02 PIPE-SLEEVE SEALS

- A. Manufacturers:
1. Advance Products & Systems, LLC; Innerlynx: www.apsonline.com/#sle.
 2. Flexicraft Industries; PipeSeal: www.flexicraft.com/#sle.
 3. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.

3.02 INSTALLATION

- A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- B. Install piping to conserve building space, to not interfere with use of space and other work.
- C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- D. Inserts:
1. Provide inserts for placement in concrete formwork.
 2. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 3. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- E. Structural Considerations: Do not penetrate building structural members unless indicated.
- F. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
 2. Aboveground Piping:
 - a. Pack solid using mineral fiber complying with ASTM C592.
 - b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
 3. All Rated Openings: Caulk tight with fire stopping material complying with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.
 4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.
- G. Manufactured 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 water-tight seal.
 6. Install in accordance with manufacturer's recommendations.
- H. 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.

3.03 CLEANING

- A. Upon completion of work, clean all parts of the installation.

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- B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION

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SECTION 220519 METERS AND GAUGES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water meters.
- B. Flow meters.
- C. Pressure gauges.

1.02 REFERENCE STANDARDS

- A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2022.
- B. ASME MFC-3M - Measurement of Fluid Flow in Pipes Using Orifice, Nozzle, and Venturi; 2004 (Reaffirmed 2017).
- C. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014 (Reapproved 2020).
- D. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014 (Reapproved 2021).
- E. AWWA C700 - Cold-Water Meters -- Displacement Type, Metal Alloy Main Case; 2020.
- F. AWWA C701 - Cold-Water Meters -- Turbine Type, for Customer Service; 2019.
- G. AWWA C702 - Cold-Water Meters -- Compound Type; 2019.
- H. AWWA M6 - Water Meters -- Selection, Installation, Testing, and Maintenance; 2012, with Addendum (2018).
- I. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.
- J. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide red-marked product data sheets for each furnished item with associated components and accessories.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Gauge Oil for Inclined Manometers: One bottle.
 - 2. Extra Pressure Gauges: One of each type and size.

PART 2 PRODUCTS

2.01 WATER METERS

2.02 ENERGY METERS

- A. Manufacturers:
 - 1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
 - 2. Venture Measurement, a Danaher Corporation Company: www.venturemeasurement.com/#sle.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Meter: Brass body turbine meter with magnetic drive register, platinum temperature sensors.
 - 1. Size: 1/2 inch.

2.03 FLOWMETERS

- A. Manufacturers:
 - 1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
 - 2. Venture Measurement, a Danaher Corporation Company: www.venturemeasurement.com/#sle.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Flow Sensing Element.

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1. In-Line Averaging 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. Maximum temperature: 400 degrees F.
 - c. Accuracy: Plus 0.55 percent to minus 2.30 percent.
2. Portable Meter: Dry single diaphragm type pressure gauge with 6 inch dial pointer, stainless steel wetted metal parts, variable pulsation damper, equalizing valve, two bleed valves, and master chart for direct conversion of meter readings to flow rate, mounted in rust-proof carrying case with two ten foot long rubber test hoses with brass valves or quick connections for measuring stations.

2.04 PRESSURE GAUGES

- A. Manufacturers:
 1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
 2. Moeller Instrument Company, Inc: www.moellerinstrument.com/#sle.
 3. Omega Engineering, Inc: www.omega.com/#sle.
 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Bourdon Tube for Liquids and Gases:
 1. Dial Size and Cover: 4-1/2 inch diameter scale with polycarbonate window.
 2. Dial Text and Markings: Black color on white background with scaled kPa and psi units.
 3. Accuracy: ASME B40.100, adjustable commercial grade (D) with 5 percent of span.
 4. Process Connection: Lower-back, 1/4 inch NPT male except where noted.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install metering products in accordance with manufacturer's instructions for intended fluid type and service.
- B. Install water meters with inlet and outlet isolation valves in compliance with AWWA M6.
- C. Locate PT (pressure-temperature) test plugs adjacent to control device sockets.

3.02 SCHEDULES

- A. Pressure Gauges, Location and Scale Range:
- B. Pressure Gauge Tappings, Location:
 1. Control valves 3/4 inch & larger - inlets and outlets.
 2. Major coils - inlets and outlets.
 3. Heat exchangers - inlets and outlets.
- C. Stem Type Thermometers, Location and Scale Range:
- D. Thermometer Sockets, Location:
 1. Control valves 1 inch & larger - inlets and outlets.
 2. Reheat coils - inlets and outlets.
 3. Cabinet heaters - inlets and outlets.
 4. Unit heaters - inlets and outlets.
- E. Dial Thermometers, Location and Scale Range:

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SECTION 220523 GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Angle valves.
- B. Ball valves.
- C. Butterfly valves.
- D. Check valves.
- E. Gate valves.
- F. Globe valves.
- G. Lubricated plug valves.
- H. Chainwheels.

1.02 ABBREVIATIONS AND ACRONYMS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Non-rising stem.
- E. OS&Y: Outside screw and yoke.
- F. PTFE: Polytetrafluoroethylene.
- G. RS: Rising stem.
- H. WOG: Water, oil, and gas.

1.03 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; 2020.
- D. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves; 2022, with Errata (2023).
- E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
- F. ASME B16.34 - Valves — Flanged, Threaded, and Welding End; 2020.
- G. ASME B31.9 - Building Services Piping; 2020.
- H. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2022.
- I. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2023).
- J. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).
- K. ASTM B61 - Standard Specification for Steam or Valve Bronze Castings; 2015 (Reapproved 2021).
- L. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.
- M. AWWA C606 - Grooved and Shouldered Joints; 2022.
- N. MSS SP-45 - Drain and Bypass Connections; 2020.
- O. MSS SP-67 - Butterfly Valves; 2022.
- P. MSS SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends; 2011.
- Q. MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends; 2018.
- R. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service; 2010a.

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- S. MSS SP-78 - Gray Iron Plug Valves, Flanged and Threaded Ends; 2011.
- T. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves; 2019.
- U. MSS SP-85 - Gray Iron Globe and Angle Valves, Flanged and Threaded Ends; 2011.
- V. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .
- W. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.
- X. NSF 372 - Drinking Water System Components - Lead Content; 2022.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.
- E. Maintenance Materials: Furnish Owner with one wrench for every five plug valves, in each size of square plug valve head.
 - 1. See Section 01 60 00 - Product Requirements for additional provisions.

1.05 EXERCISE THE FOLLOWING PRECAUTIONS FOR HANDLING:

- A. Handle large valves with sling, modified to avoid damage to exposed parts.
- B. 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. Shutoff: Ball, butterfly, .
 - 2. Dead-End: Single-flange butterfly (lug) type.
 - 3. Throttling: Provide .
 - 4. Swing Check (Pump Outlet):
 - a. 2 NPS and Smaller: Bronze swing check valves with disc.
 - b. 2-1/2 NPS and Larger for Domestic Water: Iron swing check valves with closure control, seat check valves.
 - c. 2-1/2 inch and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- 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. 2 inch and Smaller: Threaded ends.
 - b. 2-1/2 inch to 4 inch: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - c. 5 inch and Larger: Grooved or flanged ends.
 - d. Grooved-End : Grooved.
 - 2. Copper Tube:
 - a. 2 inch and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - b. 2-1/2 inch to 4 inch: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.

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- c. 5 inch and Larger: Grooved or flanged ends.
- F. Low Pressure, Compressed Air Valves 150 psi or Less:
 - 1. 2 inch and Smaller:
 - a. Bronze: Provide with ends.
 - b. Ball: One piece, full port, with brass trim.
 - c. Bronze Lift Check: Class 125, bronze disc.
 - d. Bronze Swing Check: Class 125, bronze disc.
 - e. Bronze Gate: Class 125, NRS.
 - 2. 2-1/2 inch and Larger:
 - a. Iron, 2-1/2 NPS to 4 NPS: Provide with ends.
 - b. Iron Single-Flange Butterfly: 200 CWP, NBR Seat, aluminum-bronze disc.
 - c. Iron Grooved-End Butterfly: 175 CWP.
 - d. Iron Swing Check: Class 125, metal seats.
 - e. Iron Grooved-End Swing Check: 300 CWP.
 - f. Iron Center-Guided Check: Class 125, compact-wafer, metal seat.
 - g. Iron Plate-Type Check: Class 125; single plate; metal seat.
 - h. Iron Gate: Class 125, NRS.
- G. Domestic, Hot and Cold Water Valves:
 - 1. 2 inch and Smaller:
 - a. Bronze and Brass: Provide with ends.
 - b. Bronze Angle: Class 125, bronze disc.
 - c. Ball: One piece, full port, with brass trim.
 - d. Bronze Swing Check: Class 125, bronze disc.
 - e. Bronze Gate: Class 125, NRS.
 - f. Bronze Globe: Class 125, bronze disc.
 - 2. 2-1/2 inch and Larger:
 - a. Iron, 2-1/2 NPS to 4 NPS: Provide with ends.
 - b. Iron Ball: Class 150.
 - c. Iron Single-Flange Butterfly: 200 CWP, EPDM seat, aluminum-bronze disc.
 - d. Iron Grooved-End Butterfly: 175 CWP.
 - e. Iron Swing Check: Class 125, metal seats.
 - f. Iron Swing Check with Closure Control: Class 125, lever and spring.
 - g. Iron Grooved-End Swing Check: 300 CWP.
 - h. Iron Center-Guided Check: Class 125, compact-wafer, metal seat.
 - i. Iron Plate-Type Check: Class 125; single plate; metal seat.
 - j. Iron Gate: Class 125, NRS.
 - k. Iron Globe: Class 125.
- H. Sanitary Waste Water Valves:
 - 1. 2-1/2 inch and Larger:
 - a. Iron, 2-1/2 NPS to 4 NPS: Provide with ends.
 - b. Iron Ball: Class 150.
 - c. Iron Swing Check: Class 125, metal seats.
 - d. Iron Swing Check with Closure Control: Class 125, lever and spring.
 - e. Iron Grooved-End Swing Check: 300 CWP.
 - f. Iron Gate: Class 125, NRS.
 - g. Iron Globe: Class 125.
 - h. Lubricated Plug: Class 125, regular gland.

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 inch and smaller except plug valves.
 - 4. Wrench: Plug valves with square heads.
 - 5. 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.

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- D. Insulated Piping Valves: With 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. 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. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
 - 2. Solder-joint Connections: ASME B16.18.
 - 3. 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. Valve Bypass and Drain Connections: MSS SP-45.
- I. Source Limitations: Obtain each valve type from a single manufacturer.

2.03 BRONZE, ANGLE VALVES

- A. Class 125; CWP Rating: 200 psi:
 - 1. Comply with MSS SP-80, Type 1.
 - 2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
 - 3. End Connections: Pipe thread.
 - 4. Stem: Bronze.
 - 5. Disc: Bronze.
 - 6. Packing: Asbestos free.
 - 7. Handwheel: Bronze or aluminum.

2.04 BRASS, BALL VALVES

- A. One Piece, Full Port with Brass Trim and Push-to-fit or Threaded Connections:
 - 1. Comply with MSS SP-110.
 - 2. CWP Rating: 200 psi.
 - 3. Body: Forged brass.
 - 4. Seats: PTFE.
 - 5. Stem: Brass.
 - 6. Ball: Chrome-plated brass.
 - 7. Operator: Handle.
- B. Two Piece, Full Port with Brass Trim and Female Thread, Male thread, or Solder Connections:
 - 1. Comply with MSS SP-110.
 - 2. WSP Rating: 150 psi.
 - 3. WOG Rating: 600 psi.
 - 4. Body: Forged brass.
 - 5. Seats: PTFE.
 - 6. Stem: Brass.
 - 7. Ball: Chrome-plated brass.
 - 8. Operator: Lockable handle and memory stop.
- 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. Body: Forged brass.
 - 5. End Connections: Pipe thread.
 - 6. Seats: PTFE.

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7. Stem: Stainless steel.
8. Ball: Stainless steel, vented.

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. One Piece, Reduced Port with Bronze Trim:
 1. Comply with MSS SP-110.
 2. WSP Rating: 400 psi.
 3. CWP Rating: 600 psi.
 4. Body: Bronze.
 5. End Connections: Pipe press.
 6. Seats: PTFE.
 7. Stem: Bronze.
 8. Ball: Chrome plated brass.
- C. Two Piece, Full Port with Bronze Trim:
 1. Comply with MSS SP-110.
 2. WSP Rating: 150 psi.
 3. WOG Rating: 600 psi.
 4. Body: Forged bronze or dezincified-brass alloy.
 5. Ends Connections: Pipe thread or solder.
 6. Seats: PTFE.
 7. Stem: Bronze, blowout proof.
 8. Ball: Chrome plated brass.
- D. 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. Body: Bronze.
 5. End Connections: Pipe thread or press.
 6. Seats: PTFE.
 7. Stem: Stainless steel.
 8. Ball: Stainless steel, vented.

2.06 IRON, BALL VALVES

- A. Class 125, Full Port, Stainless Steel Trim:
 1. Comply with MSS SP-72.
 2. CWP Rating: 200 psi.
 3. Body: ASTM A536 Grade 65-45-12, ductile iron.
 4. End Connections: Flanged.
 5. Seats: PTFE.
 6. Stem: Stainless steel.
 7. Ball: Stainless steel.
 8. Operator: Lever with locking handle.
 9. Manufacturers:
 - a. Apollo Valves: www.apollovalves.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.07 IRON, SINGLE FLANGE BUTTERFLY VALVES

- A. Lug Style; Bi-directional dead-end service without use of downstream flange:
 1. Class 125 or Class 150 flanges.
 2. Comply with MSS SP-67, Type I.
 3. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.
 4. Stem: One or two-piece stainless steel.
 5. Seat: EPDM.
 6. Disc: Stainless steel.
 7. Finish: Epoxy coated.
 8. Operator: Gear operator with handwheel over direct-mount actuator base.

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9. Manufacturers:
 - a. Apollo Valves: www.apollovalves.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.08 IRON, GROOVED-END BUTTERFLY VALVES

- A. CWP Rating: 175 psi.
 1. Comply with MSS SP-67, Type I.
 2. Body: Coated ductile iron.
 3. Stem: Two-piece stainless steel.
 4. Disc: Coated ductile iron.
 5. Disc Seal: EPDM.

2.09 BRONZE, LIFT CHECK VALVES

- A. General:
 1. Fabricate from dezincification resistant material.
 2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. 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: Comply with ASTM B61 or ASTM B62, bronze.
 5. End Connections: Threaded.
 6. Disc (Type 1): Bronze.

2.10 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 125:
 1. Pressure and Temperature Rating: MSS SP-80, Type 3.
 2. Design: Y-pattern, horizontal or vertical flow.
 3. WOG Rating: 200 psi.
 4. Body: Bronze, ASTM B62.
 5. End Connections: Threaded.
 6. Disc: Bronze.

2.11 IRON, HORIZONTAL SWING CHECK VALVES

- A. Class 125:
 1. Pressure and Temperature Rating: MSS SP-71, Type I.
 2. Design: T-body style for clear or full waterways.
 3. WOG Rating: 200 psi.
 4. Body: ASTM A126, gray cast iron with bolted bonnet.
 5. End Connections: Flanged.
 6. Trim: Composition.
 7. Seat Ring and Disc Holder: Bronze.
 8. Disc: PTFE.
 9. Gasket: Asbestos free.

2.12 IRON, SWING CHECK VALVES WITH CLOSURE CONTROL

- A. Class 125 with Lever and Spring-Closure Control.
 1. Comply with MSS SP-71, Type I.
 2. Description:
 - a. CWP Rating: 200 psi.
 - b. Design: Clear or full waterway.
 - c. Body: ASTM A126, gray iron with bolted bonnet.
 - d. Ends: Flanged as indicated.
 - e. Trim: Bronze.
 - f. Gasket: Asbestos free.

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- g. Closer Control: Factory installed, exterior lever, and weight.

2.13 IRON, GROOVED-END SWING CHECK VALVES

- A. Class 300:
 - 1. CWP Rating: 300 psi.
 - 2. Body: ASTM A536, Grade 65-45-12 ductile iron.
 - 3. Seal: EPDM.
 - 4. Disc: Ductile iron.
 - 5. Coating: Black, non-lead paint.

2.14 BRONZE, GATE VALVES

- A. General:
 - 1. Fabricate from dezincification resistant material.
 - 2. Copper alloys containing more than 15 percent zinc are not permitted.

2.15 IRON, GATE VALVES

- A. Bolted Bonnet: OS&Y; Rising Stem:
 - 1. Pressure and Temperature Rating: MSS SP-70, Type I.
 - 2. Class 125: WOG Rating; 200 psi.
 - 3. Body: ASTM A126, gray iron with bolted bonnet.
 - 4. End Connections: Flanged.
 - 5. Trim: Bronze.
 - 6. Disc: Solid wedge.
 - 7. Packing and Gasket: Asbestos free.

2.16 BRONZE, GLOBE VALVES

- A. General:
 - 1. Fabricate from dezincification resistant material.
 - 2. Copper alloys containing more than 15 percent zinc are not permitted.

2.17 IRON, GLOBE VALVES

- A. Class 125 and Class 250:
 - 1. Comply with MSS SP-85, Type I.
 - 2. Body: Gray iron; ASTM A126, with bolted bonnet.
 - 3. Connection Ends: Flanged.
 - 4. Trim: Bronze.
 - 5. Packing and Gasket: Asbestos free, adjustable.
 - 6. Operator: Handwheel or chainwheel.
 - 7. Pressure and Temperature Rating: ASME B16.1.

2.18 LUBRICATED PLUG VALVES

- A. Regular Gland with Flanged Ends:
 - 1. Comply with MSS SP-78, Type II.
 - 2. Body: ASTM A48/A48M or ASTM A126, cast iron with lubrication sealing system.
 - 3. Pattern: Regular or short.
 - 4. Plug: Cast iron or bronze with sealant groove.

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.

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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.

END OF SECTION

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SECTION 220529 HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Support and attachment components.

1.02 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- E. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).
- F. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).
- G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.
- C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
 - 1. Application of protective inserts, saddles, and shields at pipe hangers for each type of insulation and hanger.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 - 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
 - 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
 - 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 4. Include consideration for vibration, equipment operation, and shock loads where applicable.
 - 4. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
 - 5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
 - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

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- B. Hanger Rods:
 - 1. Threaded zinc-plated steel unless otherwise indicated.
 - 2. Minimum Size, Unless Otherwise Indicated or Required:
 - a. Equipment Supports: 1/2 inch diameter.
 - b. Piping up to 1 inch: 1/4 inch diameter.
 - c. Piping larger than 1 inch: 3/8 inch diameter.
 - d. Trapeze Support for Multiple Pipes: 3/8 inch in length.
- C. Thermal Insulated Pipe Supports:
 - 1. Manufacturers:
 - a. KB Enterprises: www.snappitz.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. General Requirements:
 - a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
 - b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
 - c. Pipe supports to be provided for nominally sized 1/2 to 30 inch iron pipes.
 - d. Insulation inserts to consist of rigid phenolic foam insulation surrounded by a 360 degree, PVC jacketing.
 - 3. PVC Jacket:
 - a. Pipe insulation protection shields to be provided with a ball bearing hinge and locking seam.
 - b. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
 - c. Thickness: 60 mil.
 - 4. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings.
- D. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
 - 1. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
 - b. Erico International Corporation, a brand of Pentair: www.erico.com/#sle.
 - c. PHP Systems/Design: www.phpsd.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Provide steel pedestals with thermoplastic or rubber base that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
 - 3. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
 - 4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
 - 5. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.
- E. Anchors and Fasteners:
 - 1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- 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. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

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- C. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- D. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- F. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.
- G. Equipment Support and Attachment:
 - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 - 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- H. Secure fasteners according to manufacturer's recommended torque settings.
- I. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Inspect support and attachment components for damage and defects.
- C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

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SECTION 220548 VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vibration isolation requirements.
- B. Seismic control requirements.
 - 1. Includes requirements for seismic qualification of equipment not specified in this section.
- C. Vibration-isolated equipment support bases.
- D. Vibration isolators.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete.

1.03 DEFINITIONS

- A. Plumbing Component: Where referenced in this section in regards to seismic controls, applies to any portion of the plumbing system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., piping).
- B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.04 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
 - 1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.
 - 2. Seismic Controls: Include seismic load capacities.
- D. Shop Drawings - Vibration Isolation Systems:

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1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.
 2. Vibration-Isolated Equipment Support Bases: Include base weights, including concrete fill where applicable; indicate equipment mounting provisions.
- E. Shop Drawings - Seismic Controls:
1. Include dimensioned plan views and sections indicating proposed plumbing component locations and distributed system routing, with locations and details of gravity supports and seismic restraints and associated attachments.
 2. Identify anchor manufacturer, type, minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
 3. Indicate proposed arrangement of distributed system trapeze support groupings.
 4. Indicate proposed locations for distributed system flexible fittings and/or connections.
 5. Indicate locations of seismic separations where applicable.
- F. Seismic Design Data:
1. Compile information on project-specific characteristics of actual installed plumbing components necessary for determining seismic design forces required to design appropriate seismic controls, including but not limited to the following.
 - a. Component operating weight and center of gravity.
 - b. Component elevation in the building in relation to the roof elevation (z/h).
 - c. Component importance factor (I_p).
 - d. For distributed systems, component materials and connection methods.
 - e. Component amplification factor (a_p) and component response modification factor (R_p), determined in accordance with ASCE 7 tables.
 - f. Applicability of overstrength factor (for certain anchorage in concrete and masonry).
- G. Certification for seismically qualified equipment; identify basis for certification.
- H. Evidence of qualifications for seismic controls designer.
- I. Evidence of qualifications for manufacturer.

1.07 QUALITY ASSURANCE

- A. Comply with applicable building code.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

- A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing plumbing equipment and/or plumbing connections to vibration-isolated equipment.
- B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:
- C. General Requirements:
1. Select vibration isolators to provide required static deflection.
 2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
- D. Equipment Isolation: As indicated on drawings.
- E. Piping Isolation:
1. Provide vibration isolators for piping supports:
 - a. Located in equipment rooms.
 - b. Located within 50 feet of connected vibration-isolated equipment and pressure-regulating valve (PRV) stations.
 - c. For piping over 2 inch located below or within 50 feet of noise-sensitive areas indicated.
 2. Minimum Static Deflection:

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- a. First Three Supports Closest to Isolated Equipment: Same as static deflection of equipment; maximum of 2 inch deflection required.
- b. Remainder of Supports: 0.75 inch deflection unless otherwise indicated.
3. Suspended Piping, Nonseismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.
4. Suspended Piping, Seismic Applications: Use seismic type resilient material isolator hangers, seismic type spring isolator hangers, or seismic type combination resilient material/spring isolator hangers.
5. Floor-Mounted Piping, Nonseismic Applications: Use open (unhoused) spring isolators.
6. Floor-Mounted Piping, Seismic Applications: Use seismic type restrained spring isolators.
7. Use modular seal or approved resilient material where vibration-isolated piping penetrates building elements (e.g., walls, floors) arranged to prevent vibration transmission to structure.

2.02 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

- A. Manufacturers:
 1. Vibration-Isolated Equipment Support Bases:
 - a. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
 - b. Mason Industries: www.mason-ind.com/#sle.
 - c. Vibration Eliminator Company, Inc: www.veco-nyc.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 2. Source Limitations: Furnish vibration-isolated equipment support bases and associated components and accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.
- B. Vibration-Isolated Concrete Inertia Bases:
 1. Description: Concrete-filled engineered steel forms with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.
 2. Minimum Base Depth: 6 inches.
 3. Minimum Base Mass (Including Concrete): 1.5 times weight of supported equipment.
 4. Concrete Reinforcement: Welded or tied reinforcing bars running both ways in a single layer.
 5. Concrete: Filled on site with minimum 3000 psi concrete in accordance with Section 03 30 00.

2.03 VIBRATION ISOLATORS

- A. Manufacturers:
 1. Vibration Isolators:
 - a. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
 - b. Mason Industries: www.mason-ind.com/#sle.
 - c. Vibration Eliminator Company, Inc: www.veco-nyc.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- B. General Requirements:
 1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.
- 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 anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Secure fasteners according to manufacturer's recommended torque settings.
- D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

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- E. Vibration Isolation Systems:
 - 1. Vibration-Isolated Equipment Support Bases:
 - a. Provide specified minimum clearance beneath base.
 - 2. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
 - 3. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
 - 4. Adjust isolators to be free of isolation short circuits during normal operation.
 - 5. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect vibration isolation and/or seismic control components for damage and defects.
- C. Vibration Isolation Systems:
 - 1. Verify isolator static deflections.
 - 2. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.
- D. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

END OF SECTION

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SECTION 220553 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

- A. Section 09 91 23 - Interior Painting: Identification painting.

1.03 REFERENCE STANDARDS

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

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Schedules:
 - 1. Submit plumbing component identification schedule listing equipment, piping, and valves.
 - 2. Detail proposed component identification data in terms of of wording, symbols, letter size, and color coding to be applied to corresponding product.
 - 3. Valve Data Format: Include id-number, location, function, and model number.
- C. Product Data: Provide manufacturers catalog literature for each product required.
- D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
- E. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 PLUMBING COMPONENT IDENTIFICATION GUIDELINE

- A. 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/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: Laminated piece with up to three lines of text.
 - 1. Letter Color: White.
 - 2. Letter Height: 1/4 inch.
 - 3. Background Color: Black.

2.03 TAGS

- A. Manufacturers:
 - 1. Advanced Graphic Engraving: www.advancedgraphicengraving.com/#sle.
 - 2. Brady Corporation: www.bradycorp.com/#sle.
 - 3. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 - 5. Seton Identification Products: www.seton.com/#sle.
- 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.

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- 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.

2.04 PIPE MARKERS

- A. Manufacturers:
 - 1. Brady Corporation: www.bradycorp.com/#sle.
 - 2. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 - 4. Seton Identification Products: www.seton.com/#sle.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Comply with ASME A13.1.
- C. Flexible Marker: Factory fabricated, semi-rigid, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid conveyed.
- D. Flexible Tape Marker: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.
- E. 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.
- F. Identification Scheme, ASME A13.1:
 - 1. Primary: External Pipe Diameter, Uninsulated or Insulated.
 - 2. Secondary: Color scheme per fluid service.
 - a. Water; Potable, Cooling, Boiler Feed, and Other: White text on green background.

2.05 CEILING TACKS

- A. Manufacturers:
 - 1. Craftmark: www.craftmarkid.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - 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.
 - 3. Heating/Cooling Valves: Blue.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive identification products.

3.02 INSTALLATION

- A. Install flexible nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags in clear view and align with axis of piping
- C. Install plastic pipe markers in accordance with manufacturer's instructions.
- D. Install plastic tape pipe marker around pipe in accordance with manufacturer's instructions.
- E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- F. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

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SECTION 220716 PLUMBING EQUIPMENT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cellular glass insulation.
- B. Flexible glass fiber insulation.
- C. Rigid glass fiber insulation.
- D. Jacketing and accessories.

1.02 REFERENCE STANDARDS

- A. 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).
- B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.
- C. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2022.
- D. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).
- E. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2022a.
- F. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).
- I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for equipment scheduled.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.05 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.

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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 FLEXIBLE GLASS FIBER INSULATION

- A. Manufacturers:
 - 1. CertainTeed Corporation: www.certainteed.com/#sle.
 - 2. Johns Manville Corporation: www.jm.com/#sle.
 - 3. Knauf Insulation; Atmosphere Duct Wrap: www.knaufinsulation.com/#sle.
 - 4. Owens Corning Corp: www.owenscorning.com/#sle.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Insulation: ASTM C553; flexible, noncombustible.
 - 1. K Value: 0.36 at 75 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
- C. Vapor Barrier Jacket: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
 - 1. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
- D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- E. Vapor Barrier Lap Adhesive: Compatible with insulation.

2.03 RIGID GLASS FIBER INSULATION

- A. Manufacturers:
 - 1. CertainTeed Corporation: www.certainteed.com/#sle.
 - 2. Johns Manville Corporation: www.jm.com/#sle.
 - 3. Knauf Insulation; Earthwool Insulation Board: www.knaufinsulation.com/#sle.
 - 4. Owens Corning Corp: www.owenscorning.com/#sle.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Insulation: ASTM C612 or ASTM C592; rigid, noncombustible.
 - 1. K Value: 0.25 at 75 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
 - 2. Maximum Service Temperature: 850 degrees F.
 - 3. Maximum Water Vapor Absorption: 5.0 percent by weight.
 - 4. Maximum Density: 8.0 pcf.
- C. Vapor Barrier Jacket:
 - 1. Kraft paper reinforced 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.
- D. Facing: 1 inch galvanized steel hexagonal wire mesh stitched on one face of insulation.

2.04 CELLULAR GLASS INSULATION

- A. Manufacturers:
 - 1. Pittsburgh Corning Corporation: www.foamglasinsulation.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Pipe and Tube Insulation: ASTM C552, Type II, Grade 6.
 - 1. K Value: 0.35 at 100 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
 - 2. Service Temperature Range: From 250 degrees F to 800 degrees F.
 - 3. Water Vapor Permeability: 0.005 perm inch maximum per inch.
 - 4. Water Absorption: 0.5 percent by volume, maximum.
 - 5. Density: 6.12 pcf, minimum.

2.05 JACKETING AND ACCESSORIES

- A. PVC Plastic:
 - 1. Manufacturers:
 - a. Johns Manville Corporation: www.jm.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Jacket: Sheet material, off-white color.
 - a. Minimum Service Temperature: Minus 40 degrees F.

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- b. Maximum Service Temperature: 150 degrees F.
- c. Moisture Vapor Permeability: 0.02 perm inch, 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. Thickness: 0.016 inch sheet.
 - 2. Finish: Smooth.
 - 3. Joining: Longitudinal slip joints and 2 inch laps.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that equipment 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. Factory Insulated Equipment: Do not insulate.
- C. Exposed Equipment: Locate insulation and cover seams in least visible locations.
- D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
- E. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.
- F. Insulated equipment containing fluids below ambient temperature: Insulate entire system.
- G. For fiberglass insulated equipment containing fluids below ambient temperature, provide vapor barrier jackets, factory-applied or field-applied, and finish with glass cloth and vapor barrier adhesive.
- H. For hot equipment containing fluids 140 degrees F or less, do not insulate flanges and unions, but bevel and seal ends of insulation.
- I. For hot equipment containing fluids over 140 degrees F, insulate flanges and unions with removable sections and jackets.
- J. Fiberglass insulated equipment containing fluids above ambient temperature: Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Finish with glass cloth and adhesive.
- K. Inserts and Shields:
 - 1. Application: Equipment 1-1/2 inches diameter or larger.
 - 2. Shields: Galvanized steel between hangers and inserts.
 - 3. Insert location: Between support shield and equipment and under the finish jacket.
 - 4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 - 5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- L. Finish insulation at supports, protrusions, and interruptions.
- M. Exterior Applications:
 - 1. Provide vapor barrier jacket or finish with glass mesh reinforced vapor barrier cement.
 - 2. Cover with aluminum, stainless steel, or _____.
- N. Cover glass fiber insulation with metal mesh and finish with heavy coat of insulating cement.
- O. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.
- P. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

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SECTION 220719 PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cellular glass insulation.
- B. Flexible elastomeric cellular insulation.
- C. Glass fiber insulation.
- D. Jacketing and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 84 00 - Firestopping.

1.03 REFERENCE STANDARDS

- A. 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).
- B. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.
- C. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.
- D. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2022.
- 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; 2023.
- G. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).
- H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 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/#sle.

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2. Johns Manville Corporation: www.jm.com/#sle.
 3. Knauf Insulation; Earthwool 1000 Degree Pipe Insulation: www.knaufinsulation.com/#sle.
 4. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: www.ocbuildingspec.com/#sle.
 5. Owens Corning Corporation; VaporWick Pipe Insulation: www.ocbuildingspec.com/#sle.
 6. Substitutions: See Section 01 60 00 - 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 inch.
- D. Fibrous Glass Fabric:
1. Cloth: Untreated; 9 oz/sq yd weight.
 2. Blanket: 1.0 pcf density.
 3. Weave: 5 by 5.
- E. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
- F. Outdoor Breather Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

2.03 CELLULAR GLASS INSULATION

- A. Manufacturers:
1. Pittsburgh Corning Corporation: www.foamglasinsulation.com/#sle.
 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Insulation: ASTM C552, Type II, Grade 6.
1. K Value: 0.35 at 100 degrees F.
 2. Service Temperature Range: From 250 degrees F to 800 degrees F.
 3. Water Vapor Permeability: 0.005 perm inch maximum per inch.
 4. Water Absorption: 0.5 percent by volume, maximum.

2.04 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturers:
1. Aeroflex USA, Inc: www.aeroflexusa.com/#sle.
 2. Armacell LLC; AP Armaflex: www.armacell.us/#sle.
 3. K-Flex USA LLC; Insul-Tube: www.kflexusa.com/#sle.
 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
1. Minimum Service Temperature: Minus 40 degrees F.
 2. Maximum Service Temperature: 220 degrees F.
 3. Connection: Waterproof vapor barrier adhesive.

2.05 JACKETING AND ACCESSORIES

- A. PVC Plastic.
1. Manufacturers:
 - a. Johns Manville Corporation: www.jm.com/#sle.
 - b. Substitutions: See Section 01 60 00 - 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. Thickness: 0.016 inch sheet.
 2. Finish: Smooth.

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3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.

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. Exposed Piping: Locate insulation and cover seams in least visible locations.
- C. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- D. 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.
- E. 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.
- F. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.
- G. 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.
- H. Inserts and Shields:
 1. Application: Piping 1-1/2 inches diameter or larger.
 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 3. Insert Location: Between support shield and piping and under the finish jacket.
 4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 07 84 00.
- J. 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.
- K. Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil, 0.001 inch thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.
- L. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.03 SCHEDULES

- A. Plumbing Systems:
 1. Domestic Hot Water Supply:
 - a. Glass Fiber Insulation:
 - 1) Pipe Size Range: 1-1/4" and less.
 - 2) Thickness: 1-1/2".

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- 3) Pipe Size Range: 1-1/2" and larger.
- 4) Thickness: 2".
2. Domestic Hot Water Recirculation:
 - a. Glass Fiber Insulation:
 - 1) Pipe Size Range: 1-1/4" and less.
 - 2) Thickness: 1-1/2".
 - 3) Pipe Size Range: 1-1/2" and larger.
 - 4) Thickness: 2"
 3. Tempered Domestic Water Supply: 1-1/2"
 4. Tempered Domestic Water Recirculation: 1-1/2"
 5. Domestic Cold Water: 1/2"
 6. Roof Drain Bodies: 1/2"
 7. Roof Drainage Above Grade: 1/2"
 8. Roof Drainage Within 10 Feet of the Exterior: 1/2"
 9. Roof Drainage Run Horizontal at Roof Level: 1/2"
 10. Plumbing Vents Within 10 Feet of the Exterior:
- B. Heating Systems:
 1. Heating Water Supply and Return: 2"
 2. Glycol Heating Supply and Return: 2"
- C. Cooling Systems:
 1. Chilled Water: 1-1/2"
- D. Other Systems: 1/2"

END OF SECTION

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SECTION 220719.11 UNDER LAVATORY PIPE AND SUPPLY COVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Under-lavatory pipe and supply covers.

1.02 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide catalog illustrations of covers, sizes, and finishes.
- C. Manufacturer's Instructions: Indicate installation methods and procedures.
- D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 UNDER-LAVATORY PIPE AND SUPPLY COVERS

- A. Manufacturers:
 - 1. Plumberex Specialty Products, Inc: www.plumberex.com/#sle.
- B. General:
 - 1. Insulate exposed drainage piping including hot, cold, and tempered water supplies under lavatories or sinks per ADA Standards.
 - 2. Adhesives, sewing threads, and two-ply laminated materials are prohibited.
 - 3. Exterior Surfaces: Smooth nonabsorbent with no finger recessed indentations for easy cleaning.
 - 4. Construction: 1/8 inch PVC with antimicrobial, antifungal, and ultraviolet light (UV) resistant properties.
- C. ASTM E84 Compliant, Under-Lavatory Insulators:
 - 1. Manufacturers:
 - a. Plumberex Specialty Products, Inc: Plumberex Trap Gear; www.plumberex.com/#sle.
 - 2. Construction: Soft, non-laminated, flexible PVC with antimicrobial, antifungal, and UV-resistant properties. Fusion molded one piece universal design for multiple P-trap configurations. Adhesives, sewing threads, and two ply laminated materials shall not be allowed. Exterior surfaces shall be smooth nonabsorbent with no finger recessed indentations for easy cleaning. Supply riser shall be flexible and a minimum of 15 inches in length.
- D. Under-Lavatory Covers with Snap-Lock Fasteners:
 - 1. Manufacturers:
 - a. Plumberex Specialty Products, Inc: Plumberex Pro-Extreme; www.plumberex.com/#sle.
 - 2. Construction: PVC with antimicrobial, antifungal, and UV-resistant properties, one piece injected molded design with internal bridge at top of J-bend to prevent separating.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install under-lavatory guards according to manufacturer's written instructions..

END OF SECTION

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SECTION 221005 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. Chemical-resistant sanitary waste piping.
- D. Domestic water piping, buried within 5 feet of building.
- E. Domestic water piping, above grade.
- F. Storm drainage piping, buried within 5 feet of building.
 - 1. Storm drainage piping, above grade.
 - 2. Natural gas piping, buried beyond 5 feet of building.
 - 3. Natural gas piping, buried within 5 feet of building.
 - 4. Natural gas piping, above grade.
 - 5. Pipe flanges, unions, and couplings.
 - 6. Pipe hangers and supports.
 - 7. Pipe sleeve-seal systems.
 - 8. Ball valves.
 - 9. Butterfly valves.
 - 10. Balancing valves.
 - 11. Pressure reducing valves.
 - 12. Pressure relief valves.
 - 13. Strainers.

1.02 RELATED REQUIREMENTS

- A. Section 22 05 16 - Expansion Fittings and Loops for Plumbing Piping.

1.03 REFERENCE STANDARDS

- A. ANSI Z21.22 - American National Standard for Relief Valves for Hot Water Supply Systems; 2015 (Reaffirmed 2020).
- B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.
- C. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2021.
- D. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
- E. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.
- F. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings: DWV; 2021.
- G. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings—DWV; 2022.
- H. ASME B31.1 - Power Piping; 2022.
- I. ASME B31.9 - Building Services Piping; 2020.
- J. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2023.
- K. ASSE 1003 - Water Pressure Reducing Valves for Potable Water Distribution Systems; 2023.
- L. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).
- M. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
- N. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2021.
- O. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.
- P. ASTM B32 - Standard Specification for Solder Metal; 2020.

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- Q. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2020.
- R. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.
- S. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.
- T. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV); 2020.
- U. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.
- V. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2023.
- W. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2020a.
- X. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2020.
- Y. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2020.
- Z. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2021.
- AA. 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.
- BB. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2023.
- CC. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- DD. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe; 2014 (Reapproved 2021).
- EE. ASTM F679 - Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings; 2021.
- FF. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.
- GG. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2023.
- HH. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2023.
- II. AWWA C550 - Protective Interior Coatings for Valves and Hydrants; 2017.
- JJ. AWWA C606 - Grooved and Shouldered Joints; 2022.
- KK. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2021.
- LL. 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.
- MM. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).
- NN. MSS SP-67 - Butterfly Valves; 2022.
- OO. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .
- PP. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.
- QQ. NSF 372 - Drinking Water System Components - Lead Content; 2022.
- RR. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

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1. See Section 01 60 00 - Product Requirements for additional provisions.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

1.07 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: ASTM A74 extra heavy weight.
 1. Fittings: Cast iron.
 2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.
- B. Cast Iron Pipe: CISPI 301, hubless.
 1. Fittings: Cast iron.
 2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.
- C. Copper Tube: ASTM B306, DWV.
 1. Fittings: ASME B16.23, cast copper, or ASME B16.29, wrought copper.
 2. Joints: ASTM B32, alloy Sn50 solder.
- D. PVC Pipe: ASTM D2665, ASTM D3034, or ASTM F679.
 1. Fittings: PVC.
 2. Joints: Push-on, using ASTM F477 elastomeric gaskets.

2.03 SANITARY WASTE PIPING, ABOVE GRADE

- A. Cast Iron Pipe: ASTM A74, service weight.
 1. Fittings: Cast iron.
 2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.
- B. Cast Iron Pipe: CISPI 301, hubless, service weight.
 1. Fittings: Cast iron.
 2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.
- C. Copper Pipe: ASTM B42.
 1. Fittings: ASME B16.23, cast copper, or ASME B16.29, wrought copper.
 2. Joints: ASTM B32, alloy Sn50 solder.
- D. Aluminum DWV Pipe:
 1. Fittings: Cast iron.
 2. Joints: ASTM C564, thermoplastic rubber coupling and stainless steel clamps.
- E. Steel Pipe: ASTM A53/A53M Schedule 40, galvanized, using one of the following joint types:
 1. Threaded Joints: ASME B16.4 cast iron fittings.
 2. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.
- F. PVC Pipe: ASTM D2729.
 1. Fittings: PVC.
 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.04 CHEMICAL-RESISTANT SANITARY WASTE PIPING

- A. PVC Pipe: ASTM D2729 or ASTM D2665.

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1. Fittings: PVC.
2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.05 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Copper Pipe: ASTM B42, hard drawn.
 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
- 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.

2.06 DOMESTIC WATER PIPING, ABOVE GRADE

- A. Copper Tube: ASTM B88 ((ASTM B88M)), Type K (A), Drawn (H).
 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 2. Joints: ASTM B32, alloy Sn95 solder.

2.07 STORM DRAINAGE PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Cast Iron Pipe: ASTM A74 extra heavy weight.
 1. Fittings: Cast iron.
 2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.
- B. Cast Iron Pipe: CISPI 301, hubless, service weight.
 1. Fittings: Cast iron.
 2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.
- C. Copper Tube: ASTM B306, DWV.
 1. Fittings: ASME B16.23, cast copper, or ASME B16.29, wrought copper.
- D. PVC Pipe: ASTM D2665 or ASTM D3034.
 1. Fittings: PVC.
 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.08 STORM DRAINAGE PIPING, ABOVE GRADE

- A. Cast Iron Pipe: ASTM A74 extra heavy weight.
- B. Cast Iron Pipe: CISPI 301, hubless, service weight.
 1. Fittings: Cast iron.
 2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.
- C. Copper Tube: ASTM B306, DWV.
 1. Fittings: ASME B16.23, cast copper, or ASME B16.29, wrought copper.
 2. Joints: ASTM B32, alloy Sn50 solder.
- D. PVC Pipe: ASTM D2665.
 1. Fittings: PVC.
 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.09 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
 1. Fittings: ASTM A234/A234M, wrought steel welding type.
 2. Joints: ASME B31.1, welded.
 3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

2.10 NATURAL GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
 1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
 2. Joints: Threaded or welded to ASME B31.1.

2.11 PIPE FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 3 inch and Under:
 1. Ferrous Pipe: Class 150 malleable iron threaded unions.
 2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.

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- B. 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. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
 - 4. When pipe is field grooved, provide coupling manufacturer's grooving tools.
- C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.12 PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58.
 - 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
 - 2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
 - 3. Trapeze Hangers: Welded steel channel frames attached to structure.
 - 4. Vertical Pipe Support: Steel riser clamp.
- B. Plumbing Piping - Drain, Waste, and Vent:
 - 1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
 - 2. Hangers for Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.
 - 3. Wall Support for Pipe Sizes 2 to 3 inch: Cast iron hook.
 - 4. Wall Support for Pipe Sizes 4 inch and Over: Welded steel bracket and wrought steel clamp.
 - 5. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 - 6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- C. Plumbing Piping - Water:
 - 1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
 - 2. Hangers for Cold Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.
 - 3. Wall Support for Pipe Sizes Up to 3 inch: Cast iron hook.
 - 4. Wall Support for Pipe Sizes 4 inch and Larger: Welded steel bracket and wrought steel clamp.
 - 5. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 - 6. Floor Support for Hot Pipe Sizes to 4 inch: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
- D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:

2.13 PIPE SLEEVE-SEAL SYSTEMS

- A. Manufacturers:
 - 1. The Metraflex Company; MetraSeal: www.metraflex.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - 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.

2.14 BALL VALVES

- A. Manufacturers:
 - 1. Apollo Valves: www.apollovalves.com/#sle.
 - 2. Grinnell Products: www.grinnell.com/#sle.
 - 3. Nibco, Inc: www.nibco.com/#sle.
 - 4. Uponor, Inc: www.uponorengineering.com/#sle.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Construction, 4 inch and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, threaded or grooved ends with union.

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2.15 BUTTERFLY VALVES

- A. Manufacturers:
 - 1. Apollo Valves: www.apollovalves.com/#sle.
 - 2. Crane Company: www.cranecpe.com/#sle.
 - 3. Grinnell Products; B302: www.grinnell.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Construction 1-1/2 inch and Larger: MSS SP-67, 200 psi CWP, cast or ductile iron body, nickel-plated ductile iron disc, resilient replaceable EPDM seat, wafer ends, extended neck, 10 position lever handle.
- C. Provide gear operators for valves 8 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.

2.16 PRESSURE REDUCING VALVES

- A. Manufacturers:
 - 1. Amtrol Inc: www.amtrol.com/#sle.
 - 2. Apollo Valves: www.apollovalves.com/#sle.
 - 3. Cla-Val Company: www.cla-val.com/#sle.
 - 4. Flomatic Valves: www.flomatic.com/#sle.
 - 5. Watts Regulator Company: www.wattsregulator.com/#sle.
 - 6. Substitutions: See Section 01 60 00 - 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.

2.17 PRESSURE RELIEF VALVES

- A. ANSI Z21.22, AGA certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.

2.18 STRAINERS

- A. Manufacturers:
 - 1. Armstrong International, Inc: www.armstronginternational.com/#sle.
 - 2. Green Country Filter Manufacturing: www.greencountryfilter.com/#sle.
 - 3. WEAMCO: www.weamco.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - 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 150, 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 iron body, Y pattern with 1/16 inch stainless steel perforated screen.
- D. Size 5 inch and Larger:
 - 1. Class 125, flanged iron body, basket pattern with 1/8 inch stainless steel perforated screen.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

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3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. See Section 22 05 16.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- H. Provide access where valves and fittings are not exposed.
- I. Install water piping to ASME B31.9.
- J. 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.
- K. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.
- L. Sleeve pipes passing through partitions, walls, and floors.
- 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.
- O. 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.

3.04 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Prior to starting work, verify system is complete, flushed, and clean.

3.05 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 reduced pressure backflow preventer and water meter with by-pass valves, pressure reducing valve, and sand strainer.

3.06 SCHEDULES

- A. Pipe Hanger Spacing:
 - 1. Metal Piping:
 - a. Pipe Size: 1/2 inch to 1-1/4 inch:
 - 1) Maximum Hanger Spacing: 6.5 ft.

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- 2) Hanger Rod Diameter: 3/8 inches.
- b. Pipe Size: 1-1/2 inch to 2 inch:
 - 1) Maximum Hanger Spacing: 10 ft.
 - 2) Hanger Rod Diameter: 3/8 inch.
- c. Pipe Size: 2-1/2 inch to 3 inch:
 - 1) Maximum Hanger Spacing: 10 ft.
 - 2) Hanger Rod Diameter: 1/2 inch.
- d. Pipe Size: 4 inch to 6 inch:
 - 1) Maximum Hanger Spacing: 10 ft.
 - 2) Hanger Rod Diameter: 5/8 inch.
- e. Pipe Size: 8 inch to 12 inch:
 - 1) Maximum hanger spacing: 14 ft.
 - 2) Hanger Rod Diameter: 7/8 inch.
- f. Pipe Size: 14 inch and Over:
 - 1) Maximum Hanger Spacing: 20 ft.
 - 2) Hanger Rod Diameter: 1 inch.
- 2. Plastic Piping:
 - a. All Sizes:
 - 1) Maximum Hanger Spacing: 6 ft.
 - 2) Hanger Rod Diameter: 3/8 inch.

END OF SECTION

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SECTION 221006 PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Drains.
- B. Cleanouts.
- C. Hose bibbs.
- D. Hydrants.
- E. Washing machine boxes and valves.
- F. Refrigerator valve and recessed box.
- G. Backwater valves.
- H. Backflow preventers.
- I. Double check valve assemblies.
- J. Water hammer arrestors.
- K. Sumps.
- L. Sanitary waste interceptors.
- M. Mixing valves.
- N. Floor drain trap seals.
- O. Catch basins and manholes.

1.02 REFERENCE STANDARDS

- A. ASME A112.6.3 - Floor Drains; 2022.
- B. ASME A112.6.4 - Roof, Deck, and Balcony Drains; 2022.
- C. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers; 2023.
- D. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent; 2021.
- E. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Prevention Assemblies; 2021.
- F. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2023.
- G. DIN 19580 - Drainage Channels for Vehicular and Pedestrian Areas - Durability, Mass Per Unit Area and Evaluation of Conformity; 2010.
- H. NSF 2 - Food Equipment; 2022.
- I. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.
- J. NSF 372 - Drinking Water System Components - Lead Content; 2022.
- K. PDI-WH 201 - Water Hammer Arresters; 2017.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.
- D. Operation Data: Indicate frequency of treatment required for interceptors.
- E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

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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. Acudor Platinum, a division of Acudor; New Construction Aluminum Drains: www.acudorplatinum.com/#sle.
 2. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.
 3. Josam Company: www.josam.com/#sle.
 4. Sani-Floor Trough Systems; Clog-Free Floor Trough Systems: www.sanifloor.com/#sle.
 5. Zurn Industries, LLC: www.zurn.com/#sle.
 6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Roof Drains:
1. Assembly: ASME A112.6.4.
 2. Body: Lacquered cast iron with sump.
 3. Strainer: Removable polyethylene dome with vandal proof screws.
 4. Accessories: Coordinate with roofing type, refer to Section :
 - a. Membrane flange and membrane clamp with integral gravel stop.
 - b. Adjustable under deck clamp.
 - c. Roof sump receiver.
 - d. Waterproofing flange.
 - e. Controlled flow weir.
 - f. Leveling frame.
 - g. Adjustable extension sleeve for roof insulation.
 - h. Perforated or slotted ballast guard extension for inverted roof.
 - i. Perforated stainless steel ballast guard extension.
 5. Manufacturers:
 - a. OMG Roofing Products; Hercules-Plus: www.omgroofing.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Parapet Drains:
1. Lacquered cast iron body with aluminum flashing clamp collar and epoxy coated sloping grate.
- D. Canopy and Cornice Drains:
1. Lacquered cast iron body with aluminum flashing clamp collar and epoxy coated flat strainer.
- E. Roof Overflow Drains:
1. Lacquered cast iron body and clamp collar and bottom clamp ring; pipe extended to 2 inches above flood elevation.
- F. Downspout Nozzles:
1. Bronze round with straight bottom section.
- G. Area Drains:
1. Assembly: ASME A112.6.4.
 2. Body: Lacquered cast iron with sump.
 3. Strainer: Round nickel-bronze.
 4. Accessories: Membrane flange and membrane clamp with integral gravel stop, with adjustable under deck clamp.
- H. Linear Drains:
1. Body: Provide PVC, ABS, or stainless-steel with sloped channel to vertical waste pipe.
 2. Clamping Ring: Stainless steel mechanism to clamp waterproof membrane to linear drain body.
- I. Floor Drain (FD-1):
1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.
- J. Floor Drain (FD-2):
1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable round nickel bronze strainer with

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removable perforated sediment bucket.

- K. Floor Drain (FD-3):
 - 1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer with polished bronze funnel or anti-splash rim.
- L. Floor Drain (FD-4):
 - 1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze extra heavy duty strainer.
- M. Floor Drain (FD-5):
 - 1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze extra heavy duty strainer with hinged grate and sediment bucket.
- N. Floor Drain (FD-6):
 - 1. Lacquered cast iron or stainless steel, two piece body with drainage flange, heavy duty grate 6 inches wide, 12 inches long, dome strainer, end plates with gaskets.
- O. Shower Channel Drain (SCD-1): Factory fabricated channel and grate with built in outlet pipe.
 - 1. Basis of Design: ACO Polymer Products, Inc., QuARTz: www.quartzbyaco.com/#sle.
 - 2. Channel Edge: Plain edge.
 - 3. Plumbing Connector Type: Stainless steel.
 - 4. Channel Length: 55 inches.
 - 5. Grate Style: Solid tray to accept tile to match floor; with drainage slot at edges.
 - 6. Substrate Construction: Wooden subfloor over joists.
 - 7. Material: Electropolished stainless steel.
 - 8. Outlet Pipe: 2 inch diameter.
- P. Prefabricated Trench Drain (TD-1): Trench drain system assembled from factory fabricated, polymer concrete castings in standard lengths and variable depths, with integral joint flanges and integral grating support rails; includes joint gaskets and grating.
 - 1. Basis of Design: ACO Polymer Products, Inc., KlassikDrain: www.acousa.com/#sle.
 - 2. Load Class: DIN 19580, Class A.
 - 3. Trench Width: 12 inches.
 - 4. Trench Section Length: 39 inches and 19-1/2 inches.
 - 5. Grating Support Rail: Stainless steel.
- Q. Self-Washing Floor Trough (FT-1):
 - 1. Comply with NSF 2 construction.
 - 2. Construction: 16 gauge, 0.0598 inch stainless steel.
 - 3. Number of Grates: 1.
 - 4. Grating: Fiberglass, green.
- R. Planter Drains:
 - 1. ASME A112.6.4; lacquered cast iron body with sump.
 - 2. Strainer: Removable polyethylene dome with stainless steel screen.
 - 3. Accessories: Membrane flange and membrane clamp with integral gravel stop.

2.03 CLEANOUTS

- A. Manufacturers:
 - 1. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.
 - 2. Josam Company: www.josam.com/#sle.
 - 3. Zurn Industries, LLC: www.zurn.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Cleanouts at Exterior Surfaced Areas (CO-1):
 - 1. Round cast nickel bronze access frame and non-skid cover.
- C. Cleanouts at Exterior Unsurfaced Areas (CO-2):
 - 1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.
- D. Cleanouts at Interior Finished Floor Areas (CO-3):
 - 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

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finish in finished floor areas.

- E. Cleanouts at Interior Finished Wall Areas (CO-4):
 - 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 (CO-5): Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.04 HOSE BIBBS

- A. Manufacturers:
 - 1. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.
 - 2. Watts Regulator Company: www.wattsregulator.com/#sle.
 - 3. Zurn Industries, LLC: www.zurn.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Interior Hose Bibbs:
 - 1. Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome-plated where exposed with handwheel, integral vacuum breaker in compliance with ASSE 1011.
- C. Interior Mixing Type Hose Bibbs:
 - 1. Bronze or brass, wall mounted, double service faucet with hose thread spout, integral stops, chrome-plated where exposed with handwheels, and vacuum breaker in compliance with ASSE 1011.

2.05 HYDRANTS

- A. Manufacturers:
 - 1. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.
 - 2. Zurn Industries, LLC: www.zurn.com/#sle.
- B. Wall Hydrants:
 - 1. ASSE 1019; freeze resistant, self-draining type with chrome-plated wall plate hose thread spout, handwheel, and integral vacuum breaker.
- C. Floor Hydrants:
 - 1. ASSE 1019; chrome-plated lockable recessed box, hose thread spout, lockshield and removable key, and vacuum breaker.

2.06 WASHING MACHINE BOXES AND VALVES

- A. Box Manufacturers:
 - 1. IPS Corporation/Water-Tite: www.ipscorp.com/#sle.
 - 2. Oatey Supply Chain Services, Inc: www.oatey.com/#sle.
 - 3. Viega LLC: www.viega.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Valve Manufacturers:
 - 1. IPS Corporation/Water-Tite: www.ipscorp.com/#sle.
 - 2. Viega LLC: www.viega.com/#sle.
 - 3. Zurn Industries, LLC: www.zurn.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Description: Plastic preformed rough-in box with brass long shank valves with wheel handles, socket for 2 inch waste, slip in finishing cover.

2.07 REFRIGERATOR VALVE AND RECESSED BOX

- A. Box Manufacturers:
 - 1. IPS Corporation/Water-Tite: www.ipscorp.com/#sle.
 - 2. Oatey Supply Chain Services, Inc: www.oatey.com/#sle.
 - 3. Viega LLC: www.viega.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.

2.08 BACKWATER VALVES

- A. Manufacturers:

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1. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.
 2. Savko Plastic Pipe & Fittings, Inc: www.savko.com/#sle.
 3. Zurn Industries, LLC: www.zurn.com/#sle.
- B. Cast Iron Backwater Valves: ASME A112.6.4; lacquered cast iron body and cover, brass valve, extension sleeve, and access cover.
- C. Plastic Backwater Valves: ABS body and valve, extension sleeve, and access cover.

2.09 BACKFLOW PREVENTERS

- A. Manufacturers:
1. Apollo Valves: www.apollovalves.com/#sle.
 2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com/#sle.
 3. Zurn Industries, LLC: www.zurn.com/#sle.
 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Reduced Pressure Backflow Preventer Assembly:
1. ASSE 1013; cast bronze body and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure, and non-threaded vent outlet.
 2. Size: _____ inch assembly with threaded gate valves.

2.10 DOUBLE CHECK-VALVE ASSEMBLIES

- A. Double Check Valve Assembly:
1. ASSE 1012; cast bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.
 2. Size: 3/4 to 2 inch, NPS assembly with threaded full port ball valves.

2.11 WATER HAMMER ARRESTORS

- A. Manufacturers:
1. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.
 2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com/#sle.
 3. Zurn Industries, LLC: www.zurn.com/#sle.
 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Water Hammer Arrestors:
1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F and maximum 250 psi working pressure.

2.12 SUMPS

- A. Manufacturers:
1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
 2. Zurn Industries, LLC: www.zurn.com/#sle.
 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Precast concrete with required openings and drainage fittings.
- C. Cover: 3/8 inch thick checkered steel plate with gasket seal frames and anchor bolts.

2.13 SANITARY WASTE INTERCEPTORS

- A. Manufacturers:
1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
 2. Zurn Industries, LLC: www.zurn.com/#sle.
 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Oil Interceptors:
1. Construction:
 - a. Material: Epoxy coated fabricated steel.
 - b. Rough-in: On floor.
 - c. Cover: Steel, epoxy coated, non-skid with gasket, securing handle, and enzyme injection port, recessed for floor finish.

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- C. Grease Interceptors:
 - 1. Construction:
 - a. Material: Epoxy-coated fabricated steel.
 - b. Rough-in: On floor.
 - c. Cover: Steel, epoxy coated, non-skid with gasket, securing handle, and enzyme injection port, recessed for floor finish.
- D. Sand/Sediment Interceptors:
 - 1. Epoxy coated cast iron body and secured cover with removable stainless steel sediment bucket.

2.14 MIXING VALVES

- A. Thermostatic Mixing Valves:
 - 1. Manufacturers:
 - a. ESBE: www.esbe.se/en.
 - b. Honeywell International Inc: www.honeywellhome.com/#sle.
 - c. Leonard Valve Company: www.leonardvalve.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Valve: Chrome-plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment.
 - 3. Accessories:
 - a. Check valve on inlets.
 - b. Volume control shut-off valve on outlet.
 - c. Stem thermometer on outlet.
 - d. Strainer stop checks on inlets.
 - 4. Cabinet: 16 gauge, 0.0598 inch prime-coated steel, for recessed mounting with keyed lock.
- B. Pressure Balanced Mixing Valves:
 - 1. Manufacturers:
 - a. Delta Faucet Company: www.deltafaucet.com/#sle.
 - b. TacoTherm Ltd: www.tacotherm.co.uk.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Valve: Chrome-plated cast brass body, stainless steel cylinder, integral temperature adjustment.
 - 3. Accessories:
 - a. Volume control shut-off valve on outlet.
 - b. Stem thermometer on outlet.
 - c. Strainer stop checks on inlets.
 - d. Cabinet: 16 gauge, 0.0598 inch prime-coated steel, for recessed mounting with keyed lock.

2.15 FLOOR DRAIN TRAP SEALS

- A. Description: Push-fit EPDM or silicone fitting with a one-way membrane.

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. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.
- F. Pipe relief from backflow preventer to nearest drain.
- G. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatory sinks, washing machine outlets, or ice maker boxes..

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- H. Install air chambers on hot and cold water supply piping to each fixture or group of fixtures (each washroom). Fabricate same size as supply pipe or 3/4 inch minimum, and minimum 18 inches long.

END OF SECTION

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SECTION 223000 PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water heaters.
- B. Domestic-water heat exchangers.
- C. Domestic hot water storage tanks.
- D. Diaphragm-type compression tanks.
- E. Water filters.
- F. Water softeners.
- G. Acid-effluent neutralizers.
- H. In-line circulator pumps.
- I. Pressure booster systems.
- J. Sump pumps.
- K. Sewage ejectors.
- L. Submersible sump pumps.
- M. Condensate removal pumps.
- N. Sanitary sewage pumps.

1.02 REFERENCE STANDARDS

- A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015 (Reaffirmed 2020).
- B. ABMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings; 2014 (Reaffirmed 2020).
- C. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2023.
- D. ICC (IPC) - International Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
- F. UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittals procedures.
- B. Product Data:
 - 1. Indicate pump type, capacity, power requirements.
 - 2. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
 - 3. Provide electrical characteristics and connection requirements.
- C. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
- D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Provide five year manufacturer warranty for domestic water heaters.

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PART 2 PRODUCTS

2.01 WATER HEATERS

- A. Manufacturers:
 - 1. A.O. Smith Water Products Co: www.hotwater.com/#sle.
 - 2. Rheem Manufacturing Company: www.rheem.com/#sle.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Residential Gas Fired:
 - 1. Type: Automatic, natural gas-fired, vertical storage.
 - 2. Performance:
 - 3. Tank: Glass lined welded steel with single flue passage, flue baffle and draft hood; thermally insulated and encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.
 - 4. Controls: Automatic water thermostat and built-in gas pressure regulator; temperature range adjustable from 120 to 170 degrees F, cast iron or sheet metal burner, safety pilot and thermocouple.
 - 5. Accessories:
 - a. Water Connections: Brass.
 - b. Dip Tube: Brass.
 - c. Drain valve.
 - d. Anode: Magnesium.
- C. Commercial Gas Fired:
 - 1. Type: Automatic, natural gas-fired, vertical storage.
 - 2. Performance:
 - 3. Tank: Glass lined welded steel ASME labeled; multiple flue passages, 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber, encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.
 - 4. Accessories:
 - a. Water Connections: Brass.
 - b. Dip Tube: Brass.
 - c. Drain valve.
 - d. Anode: Magnesium.
 - e. Temperature and Pressure Relief Valve: ASME labeled.
 - 5. Applications:
 - a. Automatic storage water heater.
 - b. Automatic circulating tank water heater.
 - c. For operation at 180 degrees F.
 - d. For operation on combustible floors.
 - e. For operation in high altitude installations.
 - 6. Controls: Automatic water thermostat with temperature range adjustable from 120 to 180 degrees F, automatic reset high temperature limiting thermostat factory set at 195 degrees F, gas pressure regulator, multi-ribbon or tubular burner, 100 percent safety shut-off pilot and thermocouple, flue baffle and draft hood.
- D. Residential Electric:
 - 1. Type: Automatic, electric, vertical storage.
 - 2. Performance:
 - 3. Electrical Characteristics:
 - 4. Tank: Glass lined welded steel, thermally insulated with one inch thick glass fiber; encased in corrosion-resistant steel jacket; baked-on enamel finish.
 - 5. Controls: Automatic water thermostat with externally adjustable temperature range from 120 to 170 degrees F, flanged or screw-in nichrome elements, enclosed controls and electrical junction box and operating light. Wire double element units so elements do not operate simultaneously.
 - 6. Accessories:
 - a. Water Connections: Brass.
 - b. Dip Tube: Brass.
 - c. Drain valve.
 - d. Anode: Magnesium.
 - e. Temperature and Pressure Relief Valve: ASME labeled.
- E. Commercial Electric:
 - 1. Type: Factory-assembled and wired, electric, vertical storage.

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2. Performance:
3. Electrical Characteristics:
4. Tank: Glass lined welded steel; 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber encased in corrosion-resistant steel jacket; baked-on enamel finish.
5. Controls: Automatic immersion water thermostat; externally adjustable temperature range from 60 to 180 degrees F, flanged or screw-in nichrome elements, high temperature limit thermostat.
6. Accessories:
7. Controls: Ventilated control cabinet, factory-wired with solid state progressive sequencing step controller, fuses, magnetic contactors, control transformer, pilot lights indicating main power and heating steps, control circuit toggle switch, electronic low-water (probe-type) cut-off, high temperature limit thermostat, flush-mounted temperature and pressure gauges.
8. Heating Elements: Flange-mounted immersion elements; individual elements sheathed with Incoloy corrosion-resistant metal alloy, rated less than 75 W/sq in.

2.02 DOMESTIC-WATER HEAT EXCHANGERS

- A. Manufacturers:
 1. Armstrong Fluid Technology: www.armstrongfluidtechnology.com/#sle.
 2. Bell & Gossett, a xylem brand: www.bellgossett.com/#sle.
 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Type: Double wall type that separates the potable water from the heat transfer medium with a space vented to the atmosphere in accordance with ICC IPC.
- C. Tubes: U-tube type with 3/4 inch diameter seamless copper tubes suitable for 125 psi working pressure.
- D. Heads: Cast iron or steel, with steel tube sheets, threaded or flanged for piping connections.
- E. Water Chamber and Tube Bundle: Removable for inspection and cleaning.
- F. Coating: Prime coat exterior.
- G. Code: ASME BPVC-VIII-1 for service pressures, ASME "U" symbol stamped on heat exchanger.
- H. Shell and Tube Type: Steel shell, with threaded or flanged piping connections and necessary tappings, steel saddle and attaching U-bolts, designed for heating fluid in shell and heated fluid in tubes.
- I. Accessories:
 1. Wells for temperature regulator sensor and high limit sensor at water outlet.
 2. ASME rated pressure and temperature relief valve on water outlet.
 3. ASME rated pressure relief valves from tapping on heated water side, set at 120 psig.
 4. ASME rated pressure relief valve on steam inlet on downstream side of control valve.
 5. Thermometers and pressure gauge tappings in water inlet and outlet.
 6. Vacuum breaker and pressure gauge tapping with pigtail siphon in shell.

2.03 DOMESTIC HOT WATER STORAGE TANKS

- A. Manufacturers:
 1. A.O. Smith Water Products Co: www.hotwater.com/#sle.
 2. Wessels Company: www.westank.com/#sle.
 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Tank: Welded steel, ASME labeled for working pressure of 125 psig, steel support saddles, tappings for accessories, threaded connections of stainless steel, access manhole.
- C. Openings: Up to 3 inches, copper-silicone threaded; over 4 inches, flanged; flanged collar for heat exchanger; manway fitting.

2.04 DIAPHRAGM-TYPE COMPRESSION TANKS

- A. Manufacturers:
 1. Amtrol Inc: www.amtrol.com/#sle.
 2. Bell & Gossett, a xylem brand: www.bellgossett.com/#sle.
 3. Taco, Inc: www.taco-hvac.com/#sle.
 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.
- C. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 12 psig.

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2.05 ACID-EFFLUENT NEUTRALIZERS

- A. Manufacturers:
 - 1. Aquapure, 3M Purification, Inc: www.aquapure.com/#sle.
 - 2. Viqua, a division of Trojan Technologies ULC: www.viqua.com/#sle.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Performance:
 - 1. Maximum Low pH Water Flow Rate: _____ gpm.
 - 2. Media consists of calcite, limestone, or _____ mineral media.

2.06 IN-LINE CIRCULATOR PUMPS

- A. Manufacturers:
 - 1. Armstrong Fluid Technology: www.armstrongfluidtechnology.com/#sle.
 - 2. Bell & Gossett, a xylem brand: www.bellgossett.com/#sle.
 - 3. Sterling SIHI GmbH: www.sterlingsihi.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Casing: Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly.
- C. Impeller: Bronze.
- D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.
- E. Seal: Carbon rotating against a stationary ceramic seat.
- F. Drive: Flexible coupling.

2.07 PRESSURE BOOSTER SYSTEMS

- A. Manufacturers:
 - 1. Armstrong Fluid Technology: www.armstrongfluidtechnology.com/#sle.
 - 2. Bell & Gossett, a xylem brand: www.bellgossett.com/#sle.
 - 3. Syncro Flo, Inc: www.syncroflo.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. System: Packaged with two pumps, factory assembled, tested, and adjusted; shipped to site as integral unit; consisting of pumps, valves, and galvanized piping, with control panel assembled on fabricated steel base with structural steel framework.
- C. Controls and Instruments: Locate in NEMA 250 Type 1 general purpose enclosure with main disconnect interlocked with door, fused circuit for each motor, magnetic starters with three overloads, control circuit transformer with fuse protection, selector switch for each pump, low limit pressure switch, low pressure alarm light, running lights, current sensing devices, minimum run timers, manual alternation, and suction and discharge pressure gauges.
- D. Lead Pump: Operate continuously with lag pump operating on system demand. Should lead pump fail to operate, next pump in sequence shall start automatically.
- E. Time Delay Relay: Prevent lag pump short cycling on fluctuating demands.
- F. Thermal Bleed Circuit with Solenoid Valve: Prevent overheating during low demand.
- G. Low Pressure Control: Stop pump operation if incoming water pressure drops to atmospheric.
- H. Pump Switch: Permit manual or automatic operation.
- I. Valving: Each pump outlet combination pressure reducing and check valve to maintain constant system pressure. Provide gate or butterfly valves on suction and discharge of each pump. Provide check valve on each pump discharge.
- J. Time Clock for Automatic Day-Night Changeover:
 - 1. Day cycle: System shall operate continuously with pressure to fixtures maintained by pressure reducing valves.
 - 2. Night Cycle: Pump shall operate intermittently on pressure switch located near pressure tank operating pump for pre-determined adjustable time period.

2.08 SUBMERSIBLE SUMP PUMPS

- A. Manufacturers:
 - 1. Goulds Water Technology, a xylem brand: www.goulds.com/#sle.

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2. Zoeller Company: www.zoeller.com/#sle.
 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Type: Completely submersible, vertical, centrifugal.
 - C. Casing: Cast iron pump body and oil filled motor chamber.
 - D. Impeller: Cast iron; open non-clog, stainless steel shaft.
 - E. Bearings: Ball bearings.
 - F. Sump: Fiberglass basin with steel cover plate; 48 inches diameter, 48 inches deep.
 - G. Accessories: Oil resistant 6 foot cord and plug with three-prong connector for connection to electric wiring system including grounding connector.
 - H. Servicing: Slide-away coupling consisting of discharge elbow secure to sump floor, movable bracket, guide pipe system, lifting chain and chain hooks.
 - I. Controls: Motor control panel containing across-the-line electric motor starters with ambient compensated quick trip overloads in each phase with manual trip button and reset button, circuit breaker, control transformer, electro mechanical alternator, hand-off-automatic selector switches, pilot lights, high water alarm pilot light, reset button and alarm horn. Provide mercury switch liquid level controls, steel shell switch encased in polyurethane foam with cast iron weight for pump on (each pump), pump off (common), and alarm.

2.09 CONDENSATE REMOVAL PUMPS

- A. Manufacturers:
 1. Franklin Electric Company: www.franklin-electric.com/#sle.
 2. Liberty Pumps Inc: www.libertypumps.com/#sle.
- B. Construction: Commercial grade, nonferrous pump with stainless steel shaft, integral discharge check valve, integral float switch, safety switch, thermoplastic reservoir, motor assembly, and power cord with ground.
- C. Safety: UL 778.
- D. Performance:
 1. Flow: Refer to schedule on drawings.
 2. Size: 48 inches diameter .
 3. Electrical Characteristics:
 - a. Refer to schedule on drawings for motor HP size.
 - b. Refer to schedule on drawings for electrical characteristics.

2.10 SANITARY SEWAGE PUMPS

- A. Centrifugal Solids Handling:
 1. Manufacturers:
 - a. Buffalo Pump, a subsidiary of Ampco-Pittsburgh Corporation: www.buffalopumps.com/#sle.
 - b. Flowserve Corporation: www.flowserve.com/#sle.
 - c. Hayward Gordon ULC: www.haywardgordon.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 2. General: Non-clogging centrifugal type suitable for pumping solids up to 3 inches in diameter without internal interstices that can collect stringy materials and solids resulting in clogging.
 3. Casing:
 - a. Capable of withstanding operating pressures 50 percent greater than the maximum operating pressure.
 - b. Plugged and tapped holes for draining and venting pump.
 - c. Volute to consist of smooth passages.
 - d. Configuration to permit removal of impeller without disturbing discharge and suction connections.
 - e. Handhole to allow cleaning and inspection of pump interior.
 - f. Lifting eyes to facilitate handling of pump.
 4. Impeller:
 - a. Design to consist of smooth passages to prevent clogging and pass fibrous or stringy material.
 - b. Securely keyed to shaft with locking arrangement preventing loosening by torque from either forward or reverse direction.
 - c. Balance statically, dynamically, and hydraulically within the operating range and to the first critical speed at 150 percent of the maximum operating speed.

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5. Wearing Rings:
 - a. Provide renewable wearing rings on the casing and impeller with wearing surfaces normal to the axis of rotation.
 - b. Construction: Cast iron.
 - c. Factory designed for simple maintenance and secured to prevent rotation.
 - d. In lieu of wearing rings on impeller and casing, replaceable steel wear plates fastened to casing may be used.
6. Pump Shaft:
 - a. Provide with adequate size and strength to transmit full driver horsepower with liberal safety factor.
 - b. Fabricate from stainless steel.
7. Pump Shaft Sleeve:
 - a. Fabricate from stainless steel.
 - b. Seal joint between shaft and sleeve to prevent leakage.
 - c. Stuffing Box:
 - 1) Factory designed for minimum 5 rings of packing with removable split type glands.
 - 2) Fabricate from same material as casing and water sealed.
8. Mechanical Seal System:
 - a. Furnish single seals to seal pump shaft against leakage.
 - b. Each seal to be held in place by its own spring system, supplemented by external liquid pressures.
 - c. System to be readily removable from the shaft.
9. Bearings:
 - a. Provide ball type designed to handle all thrust loads in either direction.
 - b. Furnish with a L-10 life of minimum 50,000 hours as required by ABMA 9 or ABMA 11.
 - c. Pumps depending only on hydraulic balance and thrust are not acceptable.
10. Lubrication:
 - a. Bearing:
11. Pump Support:
 - a. Vertical Shaft Centrifugal Pumps: Separate bases for pump and support.
12. Coupling:
 - a. Provide heavy duty, flexible type, locked to the shaft.
 - b. Disconnection of the coupling possible without removing the driver half or the pump half of the coupling from the shaft.

2.11 ELECTRICAL WORK

- A. Provide electrical motor driven equipment specified complete with motors, motor starters, controls, and wiring.
- B. Electrical characteristics to be as specified or indicated.
- C. Furnish motor starters complete with thermal overload protection and other appurtenances necessary for the motor control specified.
- D. Supply manual or automatic control and protective or signal devices required for the operation specified, and any control wiring required for controls and devices not shown.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.
- B. Coordinate with plumbing piping and related fuel piping work to achieve operating system.
- C. Domestic Water Heat Exchangers:
 1. Install domestic water heat exchangers with clearance for tube bundle removal without disturbing other installed equipment or piping.
 2. Pipe relief valves and drains to nearest floor drain.
- D. Domestic Water Storage Tanks:
 1. Provide steel pipe support, independent of building structural framing members.
 2. Clean and flush prior to delivery to site. Seal until pipe connections are made.
- E. Pumps:

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1. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

END OF SECTION

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SECTION 224000 PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flush valve water closets.
- B. Tank type water closets.
- C. Dual flush water closets.
- D. Bidets.
- E. Waterless urinals.
- F. Wall hung urinals.
- G. Lavatories.
- H. Wall-hung, solid surface, multi-station lavatory units.
- I. Wall-hung, multi-station wash fountains.
- J. All-in-one lavatory system.
- K. Sinks.
- L. Under-lavatory pipe supply covers.
- M. Bathtubs and showers.
- N. Walk-in soaking tubs.
- O. Shower receptors.
- P. Showers.
- Q. Outdoor showers.
- R. Indoor drinking fountains.
- S. Electric water coolers.
- T. Service sinks.
- U. Emergency eye and face wash.
- V. Emergency showers.

1.02 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment; 2014.
- C. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration; 2008 (Reaffirmed 2013).
- D. ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2017).
- E. ASME A112.18.1 - Plumbing Supply Fittings; 2018, with Errata.
- F. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures; 2011 (Reaffirmed 2022).
- G. ASME A112.19.1 - Enamelled Cast Iron and Enamelled Steel Plumbing Fixtures; 2024.
- H. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2018, with Errata.
- I. ASME A112.19.14 - Six-Liter Water Closets Equipped with a Dual Flushing Device; 2013 (Reaffirmed 2018).
- J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- K. IAPMO Z124 - Plastic Plumbing Fixtures; 2022, with Editorial Revision.
- L. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

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- M. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
- N. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- O. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.
- P. NSF 372 - Drinking Water System Components - Lead Content; 2022.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. Manufacturer's Instructions: Indicate installation methods and procedures.
- D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 WARRANTY

- A. See Section 01 78 00 - 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.

2.02 FLUSH VALVE WATER CLOSETS

- A. Water Closets:
 - 1. Vitreous china, ASME A112.19.2, floor mounted, siphon jet flush action, china bolt caps.
 - 2. Flush Valve: Exposed (top spud).
 - 3. Flush Operation: Sensor operated.
 - 4. Handle Height: 44 inches or less.
 - 5. Manufacturers:
 - a. Advanced Modern Technologies Corporation: www.amtcorporation.com/#sle.
 - b. American Standard, Inc: www.americanstandard-us.com/#sle.
 - c. Gerber Plumbing Fixtures LLC: www.gerberonline.com/#sle.
 - d. Kohler Company: www.kohler.com/#sle.
 - e. Zurn Industries, Inc: www.zurn.com/#sle.
 - f. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Flush Valves:
 - 1. Manufacturers:
 - a. American Standard, Inc: www.americanstandard-us.com/#sle.
 - b. Sloan Valve Company: www.sloanvalve.com/#sle.
 - c. Zurn Industries, Inc: www.zurn.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Toilet Seats:
 - 1. Manufacturers:
 - a. American Standard, Inc: www.americanstandard-us.com/#sle.
 - b. Bemis Manufacturing Company: www.bemismfg.com/#sle.
 - c. Church Seat Company: www.churchseats.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Plastic: Black finish, open front, extended back, self-sustaining hinge, brass bolts, with cover.
- D. Water Closet Carriers:
 - 1. Manufacturers:
 - a. JOSAM Company: www.josam.com/#sle.
 - b. Zurn Industries, Inc: www.zurn.com/#sle.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.

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2.03 TANK TYPE WATER CLOSETS

- A. Manufacturers:
 - 1. American Standard, Inc: www.americanstandard-us.com/#sle.
 - 2. DXV by American Standard, Inc: www.dvx.com/#sle.
 - 3. Gerber Plumbing Fixtures LLC: www.gerberonline.com/#sle.
 - 4. Kohler Company: www.kohler.com/#sle.
 - 5. Zurn Industries, Inc: www.zurn.com/#sle.
 - 6. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 DUAL FLUSH WATER CLOSETS

- A. Manufacturers:
 - 1. American Standard, Inc: www.americanstandard-us.com/#sle.
 - 2. Caroma USA, Inc: www.caromausa.com/#sle.
 - 3. Toto USA: www.totousa.com/#sle.
 - 4. Zurn Industries, Inc: www.zurn.com/#sle.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. ASME A112.19.14; high efficiency and low consumption, vitreous china, dual flush, tank type.
 - 1. Flush System: Pressure-assisted, wash down with a half-flush consumption of 1.1 gal per flush.
 - 2. Bowl: Elongated.
 - 3. Rough In: 12 inch.
 - 4. Seat: Manufacturer's standard or recommended elongated closed front seat with lid.
 - 5. Color: White.

2.05 WALL HUNG URINALS

- A. Manufacturers:
 - 1. American Standard, Inc: www.americanstandard-us.com/#sle.
 - 2. Kohler Company: www.kohler.com/#sle.
 - 3. Zurn Industries, LLC; _____: www.zurn.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.
 - 1. Consumption Volume: 1.0 gal per flush, maximum.
 - 2. Flush Valve: Exposed (top spud).
 - 3. Flush Operation: Sensor operated.
 - 4. Trapway Outlet: Integral.
- C. Flush Valves:
 - 1. Manufacturers:
 - a. American Standard, Inc: www.americanstandard-us.com/#sle.
 - b. Sloan Valve Company: www.sloanvalve.com/#sle.
 - c. Zurn Industries, Inc: www.zurn.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Urinal Carriers:
 - 1. Manufacturers:
 - a. JOSAM Company: www.josam.com/#sle.
 - b. Zurn Industries, Inc: www.zurn.com/#sle.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.

2.06 LAVATORIES

- A. Manufacturers:
 - 1. American Standard, Inc: www.americanstandard-us.com/#sle.
 - 2. Kohler Company: www.kohler.com/#sle.
 - 3. Zurn Industries, Inc: www.zurn.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Metered Faucet: ASME A112.18.1; chrome-plated metered mixing faucet with low voltage operated solenoid operator and infrared sensor, aerator and cover plate, open grid strainer.
 - 1. ASME A112.18.1; chrome plated metered mixing faucet with low voltage operated solenoid operator and infrared sensor, aerator and cover plate, open grid strainer.

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- C. Sensor Operated Faucet: Cast brass, chrome-plated, wall mounted with sensor located on neck of spout.
 - 1. Cast brass, chrome plated, deck mounted with sensor located on neck of spout.
 - 2. Spout Style: Standard.
 - 3. Power Supply:
 - a. Wired: 6 VDC, field-wired into dedicated or common power supply.
 - b. Wireless:
 - 1) Battery: Replaceable alkaline or lithium type with 200,000 cycles, minimum.
 - 2) Light Cell: Photovoltaic or infra-red cell that transforms both sunlight and artificial light into electrical energy for use and battery charging.
 - 3) Low Battery Warning: Provide red or yellow colored indicator to light periodically at 30 days of remaining capacity and continuously 2 weeks prior to get fully discharged.
 - 4. Mixing Valve: None, single line for tempered water.
 - 5. Water Supply: 3/8 inch compression connections.
 - 6. Aerator: Vandal resistant, 0.5 gpm, laminar flow device.
 - 7. Finish: Polished chrome.

2.07 WALL-HUNG, SOLID SURFACE, MULTI-STATION LAVATORY UNITS

- A. Description: Rectilinear, level-surface deck, seamless and integral elongated basin, with stainless steel enclosed pedestal cabinet.
- B. Deck and Bowl Material: Fabricate from molded engineered stone material consisting of natural quartz, granite, and other minerals in a matrix of thermoset acrylic modified bio-based polyester resin and meeting requirements of IAPMO Z124.
- C. Surface Burning Characteristics: Smoke developed index less than 450, and flame spread index less than 25, Class A, when tested in accordance with ASTM E84.
- D. Number of Wash Stations: Two.
- E. Unit Length:
- F. Soap Dispenser:
- G. Color: As selected by Architect from manufacturer's full line.
- H. Faucet Drilling: 4 inch (100 mm) centerset drilling.
- I. Access Panel: Stainless steel.
- J. Support Frame: Wall mounted, heavy gauge, stainless steel.

2.08 ALL-IN-ONE LAVATORY SYSTEM

- A. Manufacturers:
 - 1. Bradley Corporation; Advocate Lavatory System AV30: www.bradleycorp.com/#sle.
- B. Wall-Mounted Integrated Lavatory Unit: Formed from molded solid surface material with integral bowl, wall mounting frame, built-in faucet, built-in soap dispenser, and hand dryer.
- C. Bowl and Deck Material:
 - 1. Fabricate from bio-based resin and preconsumer recycled granules with minimum 25 percent preconsumer recycled content and 8 percent bio-based resins, solid surface material, certified by an approved independent testing agency and meeting requirements of IAPMO Z124.
- D. Cabinet Construction: Type 300 stainless steel end panels with No. 3 finish, with high impact polymer front enclosure, mounted to wall with stainless steel mounting frame and basin support.
- E. Fittings: Includes drain, P-trap, and flexible stainless steel supply connections.
- F. Faucet:
 - 1. Built-in vandal-resistant, low profile faucet, formed from composite fiberglass-reinforced polymer with painted, clear-coat finish, with low-voltage sensor using a zone-focused, hand-detecting, infrared, transmitting beam and timed, turn-off delay.
 - 2. Flow Rate: Not greater than 0.38 gpm.
 - 3. Solenoid Valve: 24 VAC, 50/60 Hz, electronically-activated, equipped with flow regulator and plug-in transformer.

2.09 SINKS

- A. Manufacturers:
 - 1. American Standard, Inc: www.americanstandard-us.com/#sle.

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2. Kohler Company: www.kohler.com/#sle.

2.10 UNDER-LAVATORY PIPE SUPPLY COVERS

- A. Manufacturers:
 1. Plumberex Specialty Products, Inc: www.plumberex.com/#sle.
 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. General:
 1. Insulate exposed drainage piping including hot, cold and tempered water supplies under lavatories or sinks per ADA Standards.
 2. Construction: 1/8 inch PVC with antimicrobial, antifungal and UV resistant properties.
 - a. Comply with ASME A112.18.9 for covers on accessible lavatory piping.
 - b. Comply with ICC A117.1.

2.11 BATHTUBS AND SHOWERS

- A. Manufacturers:
 1. American Standard, Inc: www.americanstandard-us.com/#sle.
 2. Kohler Company: www.kohler.com/#sle.
- B. Bathtub: ASME A112.19.1 enamelled cast iron bathtub with slip resistant surface, contoured front apron, 60 inches long.

2.12 SHOWER RECEPTORS

- A. Solid Surfacing Shower Receptors: Solid plastic resin casting, self-supporting, for installation over conventional subfloor; complying with IAPMO Z124.
 1. Material: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, renewable material filler, and pigments; homogenous, nonporous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
 2. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 450 or less, Class A, when tested in accordance with ASTM E84.
 3. Finish on Exposed Surfaces: Provide satin or matte, gloss rating of 3 to 20.
 4. Manufacturers:
 - a. American Standard, Inc: www.americanstandard-us.com/#sle.
- B. Drain Trim: Removable chrome-plated strainer and tail piece.

2.13 SHOWERS

- A. Manufacturers:
 1. American Standard, Inc: www.americanstandard-us.com/#sle.
 2. Aqua Glass Corporation: www.aquaglass.com/#sle.

2.14 INDOOR DRINKING FOUNTAINS

- A. Manufacturers:
 1. Elkay Manufacturing Company: www.elkay.com/#sle.
 2. Halsey Taylor: www.halseytaylor.com/#sle.
 3. Haws Corporation: www.hawsco.com/#sle.
 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Fountain: Molded white reinforced glass fiber with underside vandal proof cowling, hooded elevated anti-squirt bubbler with stream guard, automatic stream regulator, cross handle, mounting bracket, screwdriver stop.

2.15 ELECTRIC WATER COOLERS

- A. Manufacturers:
 1. Elkay Manufacturing Company: www.elkay.com/#sle.
 2. Haws Corporation: www.hawsco.com/#sle.
 3. Oasis International: www.oasiscoolers.com/#sle.
 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Water Cooler: Electric, mechanically refrigerated; surface mounted, ADA compliant; stainless steel top, vinyl on steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting bracket; integral air cooled condenser and stainless steel grille.
 1. Capacity: 8 gph of 50 degrees F water with inlet at 80 degrees F and room temperature of 90 degrees F, when tested in accordance with ASHRAE Std 18.

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2. Electrical: 115 VAC, 60 Hertz compressor, 6 foot cord and plug for connection to electric wiring system including grounding connector.

2.16 SERVICE SINKS

- A. Manufacturers:
 1. American Standard, Inc: www.americanstandard-us.com/#sle.
 2. Commercial Enameling Company: www.cecosinks.com/#sle.
 3. Elkay Manufacturing Company: www.elkay.com/#sle.
 4. Just Manufacturing Company: www.justmfg.com/#sle.
 5. Zurn Industries, Inc: www.zurn.com/#sle.
 6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Bowl: 36 by 24 by 10 inch high white molded stone, floor mounted, with one inch wide shoulders, vinyl bumper guard, stainless steel strainer.
- C. Trim: ASME A112.18.1 exposed wall type supply with cross handles, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges.
- D. Accessories:
 1. 5 feet of 1/2 inch diameter plain end reinforced plastic hose.
 2. Hose clamp hanger.
 3. Mop hanger.

2.17 EMERGENCY EYE AND FACE WASH

- A. Manufacturers:
 1. Haws Corporation: www.hawesco.com/#sle.
 2. Therm-Omega-Tech, Inc: www.thermomegatech.com/#sle.
 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Emergency Wash: ANSI Z358.1; wall-mounted, self-cleaning, nonclogging eye and face wash with quick opening, full-flow valves, stainless steel eye and face wash receptor, twin eye wash heads and face spray ring, stainless steel dust cover, copper alloy control valve and fittings.

2.18 EMERGENCY SHOWERS

- A. Manufacturers:
 1. Haws Corporation: www.hawesco.com/#sle.
 2. Therm-Omega-Tech, Inc: www.thermomegatech.com/#sle.
 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Emergency Shower: ANSI Z358.1; wall-mounted, self-cleaning, nonclogging 8 inch diameter stainless steel deluge shower head with elbow, one inch full flow valve with pull chain and 8 inch diameter ring, one inch interconnecting fittings.

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 loose key stops, reducers, and escutcheons.
- C. Install components level and plumb.

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- D. Install and secure fixtures in place with wall supports and bolts.
- E. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

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.

3.05 ADJUSTING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

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

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SECTION 230513 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 RELATED REQUIREMENTS

- A. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015 (Reaffirmed 2020).
- B. NEMA MG 1 - Motors and Generators; 2021.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.
- C. Test Reports: Indicate test results verifying nominal efficiency and power factor for three phase motors larger than 1/2 horsepower.
- D. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.
- E. Operation Data: Include instructions for safe operating procedures.
- F. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacture of electric motors for use, and their accessories, with minimum three years documented product development, testing, and manufacturing experience.
- B. Comply with NFPA 70.

1.06 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.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Baldor Electric Company/ABB Group: www.baldor.com/#sle.
- B. Leeson Electric Corporation: www.leeson.com/#sle.

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C. Regal-Beloit Corporation (Century): www.centuryelectricmotor.com/#sle.

2.02 GENERAL CONSTRUCTION AND REQUIREMENTS

- A. Electrical Service: Refer to Section 26 05 83 for required electrical characteristics.
- B. Electrical Service:
 - 1. Motors 1/2 HP and Smaller: 115 volts, single phase, 60 Hz.
 - 2. Motors Larger than 1/2 Horsepower: three phase, 60 Hz. Voltage as shown on contract drawings.
- C. Nominal Efficiency:
 - 1. Open Motor with Two Poles: 82.5.
 - 2. Open Motor with Four Poles: 82.5.
 - 3. Open Motor with Six Poles: 50.0.
 - 4. Enclosed Motor with Two Poles: 75.5.
 - 5. Enclosed Motor with Four Poles: 82.5.
 - 6. Enclosed Motor with Six Poles: 50.0.
- D. 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 1 limits for insulation class, service factor, and motor enclosure type.
 - 4. Motors with frame sizes 254T and larger: Energy efficient type.
- E. Explosion-Proof Motors: UL approved and labelled for hazard classification, with over temperature protection.
- F. 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.
- G. 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. Single phase motors for shaft mounted fans, oil burners, and centrifugal pumps: Split phase type.
- C. Single phase motors for shaft mounted fans or blowers: Permanent split capacitor type.
- D. Single phase motors for fans, pumps, blowers, and air compressors: Capacitor start type.
- E. Single phase motors for fans, blowers, and pumps: Capacitor start, capacitor run type.
- F. Motors located in exterior locations, wet air streams downstream of sprayed coil dehumidifiers, draw through cooling towers, air cooled condensers, humidifiers, direct drive axial fans, roll filters, explosion proof environments, and dust collection systems: Totally enclosed type.
- G. 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.
- H. Motors located outdoors and in draw through cooling towers: Totally enclosed weatherproof epoxy-sealed type.

2.04 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. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.

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- D. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.05 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

- A. Starting Torque: Exceeding one fourth of full load torque.
- B. Starting Current: Up to six times full load current.
- C. Multiple Speed: Through tapped windings.
- D. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

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. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.
- D. Design, Construction, Testing, and Performance: Comply with NEMA MG 1 for Design B motors.
- E. Insulation System: NEMA Class B or better.
- 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.

PART WINDING START WHERE INDICATED: USE PART OF WINDING TO REDUCE LOCKED ROTOR STARTING CURRENT TO APPROXIMATELY 60 PERCENT OF FULL WINDING LOCKED ROTOR CURRENT WHILE PROVIDING APPROXIMATELY 50 PERCENT OF FULL WINDING LOCKED ROTOR TORQUE.

3.01 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.

3.02 ELECTRONICALLY COMMUTATED MOTORS (ECM)

- A. Manufacturers:
 - 1. US Motors, a brand of NIDEC Motor Corporation: www.usmotors.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Applications:
 - 1. Residential:
 - a. Furnace:
 - 1) Operating Mode: Constant cfm.
 - 2) Input: Motor manufacturer to coordinate control requirements with the control board of the furnace.

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- 3) RPM: 300 through 1250.
2. Commercial:
 - a. Roof Top Unit:
 - 1) Operating Mode: Constant speed.
 - 2) Input: Motor manufacturer to coordinate control requirements with the control board of the roof top unit and/or specified sequence of operation.
 - 3) Shaft Extension: Single.
 - 4) RPM: 300 through 1200.

PART 3 EXECUTION

4.01 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.

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SECTION 230516 EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flexible pipe connectors.
- B. Expansion joints and compensators.
- C. Pipe loops, offsets, and swing joints.

1.02 REFERENCE STANDARDS

- A. EJMA (STDS) - EJMA Standards; Tenth Edition.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data:
 - 1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
 - 2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
- C. Design Data: Indicate selection calculations.
- D. Manufacturer's Instructions: Indicate manufacturer's installation instructions, special procedures, and external controls.
- E. Maintenance Data: Include adjustment instructions.
- F. Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.

PART 2 PRODUCTS

2.01 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

- A. Manufacturers:
 - 1. Mercer Rubber Company: www.mercer-rubber.com/#sle.
 - 2. The Metraflex Company: www.metraflex.com/#sle.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Inner Hose: Bronze.
- C. Exterior Sleeve: Single braided, stainless steel.
- D. Pressure Rating: 125 psi and 450 degrees F.
- E. Joint: Flanged.
- F. Size: Use pipe sized units.
- G. Maximum offset: 3/4 inch on each side of installed center line.

2.02 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

- A. Manufacturers:
 - 1. Mercer Rubber Company: www.mercer-rubber.com/#sle.
 - 2. The Metraflex Company: www.metraflex.com/#sle.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Inner Hose: Bronze.
- C. Exterior Sleeve: Braided bronze.
- D. Pressure Rating: 125 psi and 450 degrees F.
- E. Joint: Flanged.

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- F. Size: Use pipe sized units.
- G. Maximum offset: 3/4 inch on each side of installed center line.
- H. Application: Copper piping.

2.03 EXPANSION JOINTS - STAINLESS STEEL BELLOWS TYPE

- A. Manufacturers:
 - 1. Mercer Rubber Company: www.mercer-rubber.com/#sle.
 - 2. The Metraflex Company: www.metraflex.com/#sle.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Maximum Compression: 1-3/4 inches.
- C. Maximum Extension: 1/4 inch.
- D. Joint: Flanged.
- E. Size: Use pipe sized units.
- F. Application: Steel piping 3 inches and under.

2.04 EXPANSION JOINTS - EXTERNAL RING CONTROLLED STAINLESS STEEL BELLOWS TYPE

- A. Manufacturers:
 - 1. Mercer Rubber Company: www.mercer-rubber.com/#sle.
 - 2. The Metraflex Company: www.metraflex.com/#sle.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Pressure Rating: 125 psi and 400 degrees F.
- C. Maximum Compression: 15/16 inch.
- D. Maximum Extension: 5/16 inch.
- E. Maximum Offset: 1/8 inch.
- F. Joint: Flanged.
- G. Size: Use pipe sized units.
- H. Accessories: Internal flow liner and external shroud.
- I. Application: Steel piping over 2 inches.

2.05 EXPANSION JOINTS - SINGLE SPHERE, FLEXIBLE COMPENSATOR

- A. Manufacturers:
 - 1. Mercer Rubber Company: www.mercer-rubber.com/#sle.
 - 2. The Metraflex Company; Cablesphere: www.metraflex.com/#sle.
- B. Body: Teflon.
- C. Pressure Rating, Sizes 3/4 Inch to 2 Inch: 150 psi and 210 degrees F.
- D. Pressure Rating, Sizes 1-1/2 Inch to 12 Inch: 150 psi and 250 degrees F.
- E. Pressure Rating, Sizes 14 Inch to 24 Inch: 105 psi and 250 degrees F.
- F. Maximum Compression: 1/2 inch.
- G. Maximum Elongation: 3/8 inch.
- H. Maximum Offset: 3/8 inch.
- I. Maximum Angular Movement: 15 degrees.
- J. Joint: Tapped steel flanges.
- K. Size: Use pipe sized units.
- L. Accessories: Control cables.
- M. Application: Steel piping 2 inches and over.

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2.06 EXPANSION JOINTS - TWO-PLY BRONZE BELLOWS TYPE

- A. Manufacturers:
 - 1. Mercer Rubber Company: www.mercer-rubber.com/#sle.
 - 2. The Metraflex Company: www.metraflex.com/#sle.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Construction: Bronze with anti-torque device, limit stops, internal guides.
- C. Pressure Rating: 125 psi and 400 degrees F.
- D. Maximum Compression: 1-3/4 inches.
- E. Maximum Extension: 1/4 inch.
- F. Joint: Soldered.
- G. Size: Use pipe sized units.
- H. Application: Copper piping.

2.07 EXPANSION JOINTS AND LOOPS - HOSE AND BRAID

- A. Manufacturers:
 - 1. The Metraflex Company; Metraloop: www.metraflex.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Provide flexible loops with two flexible sections of hose and braid, two 90 degree elbows, and 180 degree return with support bracket and air release or drain plug.
- C. Provide flexible loops capable of movement in the x, y, and z planes. Flexible loops to impart no thrust loads to the building structure.
- D. Flexible Connectors: Flanged, braided type with wetted components of stainless steel, sized to match piping.
 - 1. Maximum Allowable Working Pressure: 150 psig at 120 degrees F.
 - 2. Accommodate the Following:
 - a. Axial Deflection in Compression and Expansion: _____ inch.
 - b. Lateral Movement: _____ inch.
 - c. Angular Rotation: 15 degrees.
 - d. Force developed by 1.5 times specified maximum allowable operating pressure.
 - 3. End Connections: Same as specified for pipe jointing.
 - 4. Provide necessary accessories including, but not limited to, swivel joints.

2.08 ACCESSORIES

- A. -----
- B. Note to Specifier: The stainless steel material option above is an accessory not relating to the material of the other products below.
- C. -----
- D. Pipe Alignment Guides:
 - 1. Manufacturers:
 - a. The Metraflex Company; PGQ Glide Riser Guide: www.metraflex.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inches travel.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with EJMA (Expansion Joint Manufacturers Association) Standards.
- C. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.

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- D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.
- E. Anchor pipe to building structure where indicated. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.
- F. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.
- G. Substitute grooved piping for vibration isolated equipment instead of flexible connectors. Grooved piping need not be anchored.

END OF SECTION

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SECTION 230517 SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe sleeves.
- B. Pipe-sleeve seals.

1.02 RELATED REQUIREMENTS

- A. Section 07 84 00 - Firestopping.
- B. Section 23 05 23 - General-Duty Valves for HVAC Piping.
- C. Section 23 05 53 - Identification for HVAC Piping and Equipment: Piping identification.
- D. Section 23 07 19 - HVAC Piping Insulation.

1.03 REFERENCE STANDARDS

- A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2022a.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Valve Stem Packings: Two for each type and size of valve.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified this section.
 - 1. Minimum three years experience.
 - 2. Approved by manufacturer.
- C. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.
- B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

- A. Manufacturers:
 - 1. Flexicraft Industries; Pipe Wall Sleeve: www.flexicraft.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Vertical Piping:
 - 1. Sleeve Length: 1 inch above finished floor.
 - 2. Provide sealant for watertight joint.
 - 3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.

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4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.
- C. Plastic or Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.
- D. Pipe Passing Through Below Grade Exterior Walls:
 1. Zinc coated or cast iron pipe.
 2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.
- E. Pipe Passing Through Concrete Beam Flanges, except where Brass Pipe Sleeves are Specified:
 1. Galvanized steel pipe or black iron pipe with asphalt coating.
 2. Connect sleeve with floor plate except in mechanical rooms.
- F. Pipe Passing Through Mechanical, Laundry, and Animal Room Floors above Basement:
 1. Galvanized steel pipe or black iron pipe with asphalt coating.
 2. Connect sleeve with floor plate except in mechanical rooms.
- G. Penetrations in concrete beam flanges are permitted but are prohibited through ribs or beams without prior approval from the Architect.
- H. Clearances:
 1. Provide allowance for insulated piping.
 2. Wall, Floor, Partitions, and Beam Flanges: 1 inch greater than external pipe diameter.
 3. All Rated Openings: Caulked tight with fire stopping material in compliance with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.

2.02 PIPE-SLEEVE SEALS

- A. Manufacturers:
 1. Advance Products & Systems, LLC; Innerlynx: www.apsonline.com/#sle.
 2. Flexicraft Industries; PipeSeal: www.flexicraft.com/#sle.
 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Modular Mechanical Sleeve-Seal:
 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 with service requirements.
 4. Glass-reinforced plastic pressure end plates.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.

3.02 INSTALLATION

- A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- B. Install piping to conserve building space, to not interfere with use of space and other work.
- C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- D. 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.
- E. Structural Considerations:
 1. Do not penetrate building structural members unless indicated.

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- F. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
 - 1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
 - 2. Aboveground Piping:
 - a. Pack solid using mineral fiber in compliance with ASTM C592.
 - b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
 - 3. All Rated Openings: Caulk tight with fire stopping material in compliance with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.
 - 4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.
- G. Manufactured 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 water-tight seal.
 - 6. Install in accordance with manufacturer's recommendations.
- H. 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.

3.03 CLEANING

- A. Upon completion of work, clean all parts of the installation.
- B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.
- C. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

END OF SECTION

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SECTION 230519 METERS AND GAUGES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pressure gauges and pressure gauge taps.
- B. Thermometers and thermometer wells.
- C. Static pressure gauges.
- D. Filter gauges.

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 2020).
- C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014 (Reapproved 2021).
- D. AWWA M6 - Water Meters -- Selection, Installation, Testing, and Maintenance; 2012, with Addendum (2018).
- E. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.
- C. Operation and Maintenance Data:
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.04 FIELD CONDITIONS

- A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.01 PRESSURE GAUGES

- A. Manufacturers:
 - 1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
 - 2. Moeller Instrument Company, Inc: www.moellerinstrument.com/#sle.
 - 3. Omega Engineering, Inc: www.omega.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
 - 1. Case: Steel with brass bourdon tube.
 - 2. Size: 4-1/2 inch diameter.
 - 3. Mid-Scale Accuracy: One percent.
 - 4. Scale: Psi and KPa.

2.02 PRESSURE GAUGE TAPPINGS

- A. Gauge Cock: Tee or lever handle, brass for maximum 150 psi.
- B. Needle Valve: Brass, 1/4 inch NPT for minimum 150 psi.
- C. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections.
- D. Syphon: Steel, Schedule 40, 1/4 inch angle or straight pattern.

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2.03 STEM TYPE THERMOMETERS

- A. Manufacturers:
 - 1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
 - 2. Omega Engineering, Inc: www.omega.com/#sle.
 - 3. Weksler Glass Thermometer Corp; _____: www.wekslerglass.com/#sle.
- B. Thermometers - Fixed Mounting: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish.
 - 1. Size: 9 inch scale.
 - 2. Window: Clear Lexan.
 - 3. Stem: brass.
 - 4. Accuracy: 2 percent, per ASTM E77.
 - 5. Calibration: Degrees F.
- C. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
 - 1. Size: 9 inch scale.
 - 2. Window: Clear Lexan.
 - 3. Stem: 3/4 inch NPT brass.
 - 4. Accuracy: 2 percent, per ASTM E77.
 - 5. Calibration: Degrees F.

2.04 DIAL THERMOMETERS

- A. Manufacturers:
 - 1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
 - 2. Omega Engineering, Inc: www.omega.com/#sle.
 - 3. Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Thermometers - Fixed Mounting: Dial type bimetallic actuated; ASTM E1; stainless steel case, silicone fluid damping, white with black markings and black pointer, hermetically sealed lens, stainless steel stem.
 - 1. Size: 5 inch diameter dial.
 - 2. Lens: Clear glass.
 - 3. Accuracy: 1 percent.
 - 4. Calibration: Degrees F.
- C. Thermometer: ASTM E1, stainless steel case, adjustable angle with front recalibration, bimetallic helix actuated with silicone fluid damping, white with black markings and black pointer hermetically sealed lens, stainless steel stem.
 - 1. Size: 3 inch diameter dial.
 - 2. Lens: Clear glass.
 - 3. Accuracy: 1 percent.
 - 4. Calibration: Degrees F.
- D. Thermometers: Dial type vapor or liquid actuated; ASTM E1; stainless steel case, with brass or copper bulb, copper or bronze braided capillary, white with black markings and black pointer, glass lens.
 - 1. Size: 4-1/2 inch diameter dial.
 - 2. Lens: Clear glass.
 - 3. Length of Capillary: Minimum 5 feet.
 - 4. Accuracy: 2 percent.
 - 5. Calibration: Degrees F.

2.05 THERMOMETER SUPPORTS

- A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.
- B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

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2.06 TEST PLUGS

- A. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F.
- B. Test Kit: Carrying case, internally padded and fitted containing one 2-1/2 inch diameter pressure gauges, one gauge adapters with 1/8 inch probes, two 1 inch dial thermometers.

2.07 STATIC PRESSURE GAUGES

- A. Manufacturers:
 - 1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
 - 2. Omega Engineering, Inc: www.omega.com/#sle.
 - 3. Veris Industries: www.veris.com/#sle.
 - 4. Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.
- B. 3-1/2 inch diameter dial in metal case, diaphragm actuated, black figures on white background, front recalibration adjustment, 2 percent of full scale accuracy.
- C. Inclined manometer, red liquid on white background with black figures, front recalibration adjustment, 3 percent of full scale accuracy.
- D. Accessories: Static pressure tips with compression fittings for bulkhead mounting, 1/4 inch diameter tubing.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install positive displacement meters with isolating valves on inlet and outlet to AWWA M6. Provide full line size valved bypass with globe valve for liquid service meters.
- C. Provide one pressure gauge per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gauge.
- D. Install pressure gauges with pulsation dampers. Provide gauge cock to isolate each gauge. Provide siphon on gauges in steam systems. Extend nipples and siphons to allow clearance from insulation.
- E. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.
- F. Install thermometers in air duct systems on flanges.
- G. Install thermometer sockets adjacent to controls system thermostat, transmitter, or sensor sockets. Refer to Section 23 09 43. Where thermometers are provided on local panels, duct or pipe mounted thermometers are not required.
- H. Locate duct mounted thermometers minimum 10 feet downstream of mixing dampers, coils, or other devices causing air turbulence.
- I. Coil and conceal excess capillary on remote element instruments.
- J. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- K. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- L. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.
- M. Locate test plugs adjacent thermometers and thermometer sockets.

3.02 SCHEDULE

- A. Pressure Gauges, Location and Scale Range:
 - 1. Pumps, .
 - 2. Expansion tanks, .
 - 3. Pressure tanks, .
 - 4. Pressure reducing valves, .
 - 5. Backflow preventers, .

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- B. Pressure Gauge Tappings, Location:
 - 1. Major coils - inlets and outlets.
 - 2. Heat exchangers - inlets and outlets.
 - 3. Chiller - inlets and outlets.
 - 4. Boiler - inlets and outlets.
- C. Stem Type Thermometers, Location and Scale Range:
 - 1. Headers to central equipment, .
 - 2. Heat exchangers - inlets and outlets, .
 - 3. Boilers - inlets and outlets, .
 - 4. Chiller - inlets and outlets, .
 - 5. Domestic hot water supply and recirculation, .
- D. Thermometer Sockets, Location:
 - 1. Control valves 1 inch & larger - inlets and outlets.
 - 2. Reheat coils - inlets and outlets.
- E. Dial Thermometers, Location and Scale Range:
 - 1. Outside air.
 - 2. Return air.
 - 3. Mixed air.
- F. Static Pressure and Filter Gauges, Location and Scale Range:
 - 1. Built up filter banks.
 - 2. Unitary filter sections.
 - 3. Supply fan discharge.

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SECTION 230523 GENERAL DUTY VALVES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Angle valves.
- B. Globe valves.
- C. Ball valves.
- D. Butterfly valves.
- E. Check valves.
- F. Gate valves.
- G. Plug valves.

1.02 ABBREVIATIONS AND ACRONYMS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. PTFE: Polytetrafluoroethylene.
- G. RS: Rising stem.
- H. TFE: Tetrafluoroethylene.
- I. WOG: Water, oil, and gas.

1.03 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; 2020.
- D. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves; 2022, with Errata (2023).
- E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
- F. ASME B16.34 - Valves — Flanged, Threaded, and Welding End; 2020.
- G. ASME B31.9 - Building Services Piping; 2020.
- H. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2022.
- I. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2023).
- J. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).
- K. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).
- L. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.
- M. AWWA C606 - Grooved and Shouldered Joints; 2022.
- N. MSS SP-67 - Butterfly Valves; 2022.
- O. MSS SP-68 - High Pressure Butterfly Valves with Offset Design; 2021.
- P. MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends; 2018.
- Q. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service; 2010a.

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- R. MSS SP-78 - Gray Iron Plug Valves, Flanged and Threaded Ends; 2011.
- S. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves; 2019.
- T. MSS SP-85 - Gray Iron Globe and Angle Valves, Flanged and Threaded Ends; 2011.
- U. MSS SP-108 - Resilient-Seated Cast Iron Eccentric Plug Valves; 2020.
- V. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.
- E. Maintenance Materials: Furnish Owner with one wrench for every five plug valves, in each size of square plug valve head.
 - 1. See Section 01 60 00 - Product Requirements for additional provisions.

1.05 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.

1.06 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. Isolation (Shutoff): Butterfly, Gate, Ball, and Plug.
 - 2. Swing Check (Pump Outlet):
 - a. Size 2 inch and Smaller: Bronze with bronze disc.

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- b. 2-1/2 NPS and Larger: Iron with lever and weight, lever and spring, center-guided metal, or center-guided with resilient seat.
- 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. Size 2-1/2 inch and Larger: Grooved 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, Brass and Bronze Valves:
 - a. Threaded ends.
 - b. Angle: Bronze disc, Class 125.
 - c. Ball: Full port, one piece, brass trim.
 - d. Swing Check: Bronze disc, Class.
 - e. Gate: NRS, Class 125.
 - f. Globe: Bronze disc, Class 125.
 - 2. Size 2-1/2 inch and Larger, Iron Valves:
 - a. 2-1/2 inch to 4 inch: Threaded ends.
 - b. Ball: 2-1/2 NPS 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. Butterfly: High performance, single flange, Class 150.
 - g. Swing Check: Metal seats, Class 125.
 - h. Grooved-End Check: 3 inch to 12 inch, 300 CWP.
 - i. Center-Guided Check: Compact-wafer, metal seat, Class 125.
 - j. Gate: NRS, Class 125.
 - k. Globe: Class 125.
 - l. Lubricated Plug: Regular gland, threaded, Class 125.
 - m. Eccentric Plug: Resilient seating, 175 CWP.
- G. Condenser Water Valves:
 - 1. 2 NPS and Smaller, Brass and Bronze Valves:
 - a. Threaded ends.
 - b. Angle: Bronze disc, Class 125.
 - c. Ball: Full port, one piece, brass trim.
 - d. Swing Check: Bronze disc, Class 125.
 - e. Gate: NRS, Class 125.
 - f. Globe: Bronze disc, Class 125.
 - 2. Size 2-1/2 inch and Larger, Iron Valves:
 - a. 2-1/2 inch to 4 inch: Threaded 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. Grooved-End Butterfly: 2-1/2 inch to 12 inch, 175 CWP.
 - e. Swing Check: Metal seats, Class 125.
 - f. Grooved-End Swing Check: 3 inch to 12 inch, 300 CWP.
 - g. Iron Gate: NRS, Class 125.
 - h. Iron Globe: 2-1/2 inch to 12 inch, Class 125.
- H. Heating Hot Water Valves:
 - 1. 2 NPS and Smaller, Brass and Bronze Valves:
 - a. Threaded ends.
 - b. Angle: Bronze disc, Class 125.
 - c. Ball: Full port, one piece, brass trim.
 - d. Swing Check: Bronze disc, Class 125.
 - e. Gate: NRS, Class 125.
 - f. Globe: Bronze disc, Class 125.

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2. Size 2-1/2 inch and Larger, Iron Valves:
 - a. 2-1/2 inch to 4 inch: Threaded 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. Grooved-End Butterfly: 2-1/2 inch to 12 inch, 175 CWP.
 - e. Swing Check: Metal seats, Class 125.
 - f. Swing Check: 2-1/2 inch to 12 inch, lever and spring closure control, Class 125.
 - g. Grooved-End Swing Check: 3 inch to 12 inch, 300 CWP.
 - h. Gate: NRS, Class 125.
 - i. Globe: 2-1/2 inch to 12 inch, Class 125.
- I. Low Pressure Steam Valves for Pressures of 15 psi or Less:
 1. 2 NPS and Smaller, Brass and Bronze Valves:
 - a. Angle: Bronze disc, Class 125.
 - b. Ball: Full port, one piece, brass trim.
 - c. Swing Check: Bronze disc, Class 125.
 - d. Gate: NRS, Class 125.
 - e. Globe: Bronze disc, Class 125.
 2. Size 2-1/2 inch and Larger, Iron Valves:
 - a. 2-1/2 NPS to 4 NPS: Threaded or Flanged ends.
 - b. Ball: 2-1/2 inch to 10 inch, Class 150.
 - c. Swing Check: Metal seats, Class 125.
 - d. Swing Check: 2-1/2 inch to 12 inch, lever and spring closure. control, Class 125.
 - e. Gate: NRS, Class 125.
 - f. Globe: 2-1/2 inch to 12 inch: Class 125.
- J. High Pressure Steam Valves for Pressures Greater than 15 psi:
 1. 2 NPS and Smaller, Brass and Bronze Valves:
 - a. Angle: Bronze disc, Class 125.
 - b. Ball: Full port, one piece, brass trim.
 - c. Swing Check: Bronze disc, Class 125.
 - d. Gate: NRS, Class 125.
 - e. Globe: Bronze disc, Class 125.
 2. Size 2-1/2 inch and Larger, Iron Valves:
 - a. 2-1/2 NPS to 4 NPS: Threaded or Flanged ends.
 - b. Ball: 2-1/2 inch to 10 inch, Class 150.
 - c. Butterfly: High performance, single flange, Class 150.
 - d. Gate: NRS, Class 125.
 - e. Globe: 2-1/2 inch to 12 inch, Class 125.
- K. Steam-Condensate Valves:
 1. 2 NPS and Smaller, Brass and Bronze Valves:
 - a. Gate: NRS and RS, Class 125.
 - b. Ball: Full port, one piece, brass trim.
 - c. Angle: Bronze disc, Class 150.
 - d. Globe: Bronze disc, Class 125.
 2. Size 2-1/2 inch and Larger, Iron Valves:
 - a. Provide to with threaded or flanged ends.
 - b. Ball: 2-1/2 inch to 10 inch, Class 150.
 - c. Butterfly: High performance, single flange, Class 300.
 - d. Swing Check: Metal seats, Class 125.
 - e. Gate: NRS, Class 125.
 - f. Globe: 2-1/2 inch to 12 inch, Class 125.

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 and smaller _____.
 2. Wrench: Plug valves with square heads.

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- D. Memory Stops: Fully adjustable after insulation is installed.
- 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. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
 - 2. Building Services Piping Valves: ASME B31.9.
- G. Bronze Valves:
 - 1. Fabricate from dezincification resistant material.
 - 2. Copper alloys containing more than 15 percent zinc are not permitted.
- H. Source Limitations: Obtain each valve type from a single manufacturer.

2.03 BRONZE, ANGLE VALVES

- A. CWP Rating: Class 125: 200 psi and Class 150: 300 psi:
 - 1. Comply with MSS SP-80, Type 1.
 - 2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
 - 3. Ends: Threaded.
 - 4. Stem: Bronze.
 - 5. Disc: Bronze, PTFE, or TFE.
 - 6. Packing: Asbestos free.
 - 7. Handwheel: Bronze or aluminum.

2.04 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. Stem and Disc: Bronze or PTFE.
 - 5. Packing: Asbestos free.
 - a. Handwheel: Malleable iron.

2.05 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.

2.06 BRASS, BALL VALVES

- A. One Piece, Full Port with Brass Trim and Push-to-fit or Threaded Connections:
 - 1. Comply with MSS SP-110.
 - 2. CWP Rating: 200 psi.
 - 3. Body: Forged brass.
 - 4. Ends: Threaded.
 - 5. Seats: PTFE or TFE.
 - 6. Stem: Brass.
 - 7. Ball: Chrome-plated brass.
- B. Two Piece, Full Port and Regular Port with Stainless Steel Trim:
 - 1. Comply with MSS SP-110.
 - 2. SWP Rating: 150 psi.
 - 3. WOG Rating: 600 psi.

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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, SINGLE FLANGE BUTTERFLY VALVES

- A. Lug Style; Bidirectional dead-end service without use of downstream flange:
 - 1. Comply with MSS SP-67, Type I.
 - 2. Lug Style, CWP Ratings:
 - a. Sizes 2 to 12 inch: 150 psi.
 - b. Sizes 14 to 24 inch: 100 psi.
 - c. Vacuum Service: Down to 29.9 in-Hg.
 - 3. Stem: One or two-piece stainless steel.
 - 4. Seat: NBR.
 - 5. Disc: Coated ductile iron.

2.09 IRON, GROOVED-END BUTTERFLY VALVES

2.10 HIGH-PERFORMANCE, SINGLE FLANGE BUTTERFLY VALVES

- A. Lug type; Bidirectional dead end service without downstream flange:
 - 1. Comply with MSS SP-68.
 - 2. Body: Provide carbon steel, cast iron, ductile Iron, or stainless steel.
 - 3. Seat: Metal or reinforced PTFE.
 - 4. Offset stem: Stainless steel.
 - 5. Disc: Carbon steel.

2.11 BRONZE, SWING CHECK VALVES

2.12 IRON, FLANGED END SWING CHECK VALVES

2.13 IRON, SWING CHECK VALVES WITH CLOSURE CONTROL

2.14 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. Seal: EPDM or Nitrile.
 - 4. Disc: Ductile iron.
 - 5. Coating: Black, non-lead paint.

2.15 IRON, CENTER-GUIDED CHECK VALVES

2.16 BRONZE, GATE VALVES

2.17 IRON, GATE VALVES

2.18 LUBRICATED PLUG VALVES

- A. Regular Gland and Cylindrical with Threaded Ends:
 - 1. Comply with MSS SP-78, Type II.
 - 2. Body Material: Cast iron with lubrication sealing system.
 - 3. Pattern: Regular or short.
 - 4. Plug: Cast iron or bronze with sealant groove.

2.19 ECCENTRIC PLUG VALVES

- A. Resilient Seating with Flanged Ends.

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1. Comply with MSS SP-108.
2. CWP Rating: 175 psi minimum.
3. Body and Plug: Gray or ductile iron.
4. Bearings: Oil-impregnated bronze or Stainless Steel.
5. Stem-Seal Packing: Asbestos free.
6. Plug, Resilient-Seating Material: Approved for potable water service.

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. Provide chainwheels on operators for valves 4 NPS and larger where located 96 NPS or more above finished floor, terminating 60 NPS above finished floor.

END OF SECTION

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SECTION 230529 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Support and attachment components.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

1.03 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.
- D. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- F. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).
- G. MFMA-4 - Metal Framing Standards Publication; 2004.
- H. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).
- I. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.
 - 1. Fiberglass Channel (Strut) Framing Systems: Include requirements for strength derating according to ambient temperature.
- C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

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1. Application of protective inserts, saddles, and shields at pipe hangers for each type of insulation and hanger.
- D. Derating Calculations for Fiberglass Channel (Strut) Framing Systems: Indicate load ratings adjusted for applicable service conditions.
- E. Manufacturer's 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.

1.06 QUALITY ASSURANCE

- A. Comply with applicable building code.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of _____. Include consideration for vibration, equipment operation, and shock loads where applicable.
 4. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
 5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
 - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
 1. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
 - b. Thomas & Betts Corporation: www.tnb.com/#sle.
 - c. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 - e. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.
 2. Provide factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
 3. Comply with MFMA-4.
 4. Channel Material:
 - a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
 5. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.
 6. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.
- C. Fiberglass Channel (Strut) Framing Systems:
 1. Manufacturers:
 - a. Enduro Composites; _____: www.endurocomposites.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 - c. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.

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2. Factory-fabricated continuous-slot fiberglass channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
 3. Channel Material: Use polyester resin or vinyl ester resin.
 4. Minimum Channel Dimensions: 1-5/8 inch width by 1 inch height.
 5. Flammability: Fire retardant with NFPA 101, Class A flame spread index (maximum of 25) when tested in accordance with ASTM E84; self-extinguishing in accordance with ASTM D635.
- D. Hanger Rods:
1. Threaded zinc-plated steel unless otherwise indicated.
 2. Minimum Size, Unless Otherwise Indicated or Required:
 - a. Equipment Supports: 1/2 inch diameter.
 - b. Piping up to 1 inch: 1/4 inch diameter.
 - c. Piping larger than 1 inch: 3/8 inch diameter.
 - d. Trapeze Support for Multiple Pipes: 3/8 inch diameter.
- E. Steel Cable:
1. Manufacturers:
 - a. Ductmate Industries, Inc, a DMI Company; Clutcher Cable Hanging System: www.ductmate.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 - c. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.
- F. Thermal Insulated Pipe Supports:
1. Manufacturers:
 - a. KB Enterprises: www.snappitz.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 2. General Requirements:
 - a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
 - b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
 - c. Pipe supports to be provided for nominally sized, 1/2 to 30 inch iron pipes.
 - d. Insulation inserts to consist of rigid polyisocyanurate (urethane) insulation surrounded by a 360 degree, PVC jacketing.
 3. PVC Jacket:
 - a. Pipe insulation protection shields to be provided with a ball bearing hinge and locking seam.
 - b. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
 - c. Thickness: 60 mil.
 4. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings.
- G. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
1. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
 - b. Erico International Corporation, a brand of Pentair: www.erico.com/#sle.
 - c. PHP Systems/Design: www.phpsd.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 2. Provide steel pedestals with thermoplastic or rubber base that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
 3. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
 4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
 5. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.
- H. Anchors and Fasteners:
1. Manufacturers - Mechanical Anchors:
 - a. Hilti, Inc: www.us.hilti.com/#sle.
 - b. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com/#sle.
 - c. Powers Fasteners, Inc: www.powers.com/#sle.
 - d. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.

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2. Manufacturers - Powder-Actuated Fastening Systems:
 - a. Hilti, Inc: www.us.hilti.com/#sle.
 - b. ITW Ramset, a division of Illinois Tool Works, Inc: www.ramset.com/#sle.
 - c. Powers Fasteners, Inc: www.powers.com/#sle.
 - d. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
3. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
4. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
5. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
6. Hollow Masonry: Use toggle bolts.
7. Hollow Stud Walls: Use toggle bolts.
8. Sheet Metal: Use sheet metal screws.
9. Wood: Use wood screws.
10. Plastic and lead anchors are not permitted.
11. Powder-actuated fasteners are permitted only as follows:
 - a. Where approved by Architect.
12. Hammer-driven anchors and fasteners are permitted only as follows:
 - a. Nails are permitted for attachment of nonmetallic boxes to wood frame construction (when specified).
 - b. Staples are permitted for attachment of nonmetallic-sheathed cable to wood frame construction (when specified).
13. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
 - a. Comply with MFMA-4.
 - b. Channel Material: Use galvanized steel.
 - c. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch minimum base metal thickness.
 - d. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
14. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- 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 anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
- D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.
- H. Equipment Support and Attachment:
 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.

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3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3 inch high concrete pad constructed in accordance with Section 03 30 00.
 5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- I. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.
 - J. Secure fasteners according to manufacturer's recommended torque settings.
 - K. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Inspect support and attachment components for damage and defects.
- C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

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SECTION 230548 VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vibration isolation requirements.
- B. Seismic control requirements.
- C. Vibration-isolated equipment support bases.
- D. Vibration isolators.
- E. External seismic snubber assemblies.
- F. Seismic restraint systems.
- G. Vibration-isolated and/or seismically engineered roof curbs.

1.02 RELATED REQUIREMENTS

- A. Section 01 45 33 - Code-Required Special Inspections and Procedures.
- B. Section 03 30 00 - Cast-in-Place Concrete.
- C. Section 05 50 00 - Metal Fabrications: Materials and requirements for fabricated metal supports.
- D. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

1.03 DEFINITIONS

- A. HVAC Component: Where referenced in this section in regards to seismic controls, applies to any portion of the HVAC system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., ductwork, piping).
- B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.04 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASCE 19 - Structural Applications of Steel Cables for Buildings; 2016.
- C. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.
- D. MFMA-4 - Metal Framing Standards Publication; 2004.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Seismic Controls:
 - a. Coordinate the arrangement of seismic restraints with piping, conduit, equipment, and other potential conflicts installed under other sections or by others.
 - b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:

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1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
 1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.
 2. Seismic Controls: Include seismic load capacities.
- D. Shop Drawings - Vibration Isolation Systems:
 1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.
 2. Vibration-Isolated Equipment Support Bases: Include base weights, including concrete fill where applicable; indicate equipment mounting provisions.
- E. Shop Drawings - Seismic Controls:
 1. Include dimensioned plan views and sections indicating proposed HVAC component locations and distributed system routing, with locations and details of gravity supports and seismic restraints and associated attachments.
 2. Identify mounting conditions required for equipment seismic qualification.
 3. Identify anchor manufacturer, type, minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
 4. Indicate proposed arrangement of distributed system trapeze support groupings.
 5. Indicate proposed locations for distributed system flexible fittings and/or connections.
 6. Indicate locations of seismic separations where applicable.
 7. Include point load drawings indicating design loads transmitted to structure at each attachment location.
- F. Seismic Design Data:
 1. Compile information on project-specific characteristics of actual installed HVAC components necessary for determining seismic design forces required to design appropriate seismic controls, including but not limited to the following.
 - a. Component operating weight and center of gravity.
 - b. Component elevation in the building in relation to the roof elevation (z/h).
 - c. Component importance factor (I_p).
 - d. For distributed systems, component materials and connection methods.
 - e. Component amplification factor (a_p) and component response modification factor (R_p), determined in accordance with ASCE 7 tables.
 - f. Applicability of overstrength factor (for certain anchorage in concrete and masonry).
 2. Include structural calculations, stamped or sealed by seismic controls designer, demonstrating suitability of seismic controls for seismic design forces.
- G. Certification for seismically qualified equipment; identify basis for certification.
- H. Evaluation Reports: For products specified as requiring evaluation and recognition by a qualified evaluation service, provide current evaluation reports.
- I. Manufacturer's 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.
- J. Evidence of qualifications for seismic controls designer.
- K. Evidence of qualifications for manufacturer.
- L. Manufacturer's detailed field testing and inspection procedures.
- M. Field quality control test reports.

1.07 QUALITY ASSURANCE

- A. Comply with applicable building code.

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- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Seismic Controls Designer Qualifications: Registered professional engineer licensed in the State in which the Project is located and with minimum five years experience designing seismic restraints for nonstructural components.
 - 1. Designer may be employed by the manufacturer of the seismic restraint products.
- D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

- A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing HVAC equipment and/or HVAC connections to vibration-isolated equipment.
- B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:
- C. General Requirements:
 - 1. Select vibration isolators to provide required static deflection.
 - 2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
 - 3. Select seismic type vibration isolators to comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
 - 4. Select vibration isolators for outdoor equipment to comply with wind design requirements.
 - 5. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2-inch operating clearance beneath base unless otherwise indicated.
- D. Equipment Isolation: As indicated on drawings.
- E. Piping Isolation:
 - 1. Provide vibration isolators for piping supports:
 - a. Located in equipment rooms.
 - b. Located within 50 feet of connected vibration-isolated equipment and pressure-regulating valve (PRV) stations.
 - c. For piping over 2 inch located below or within 50 feet of noise-sensitive areas indicated.
 - 2. Minimum Static Deflection:
 - a. Remainder of Supports: 0.75 inch deflection unless otherwise indicated.
 - 3. Suspended Piping, Nonseismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.
 - 4. Suspended Piping, Seismic Applications: Use seismic type resilient material isolator hangers, seismic type spring isolator hangers, or seismic type combination resilient material/spring isolator hangers.
 - 5. Floor-Mounted Piping, Nonseismic Applications: Use open (unhoused) spring isolators.
 - 6. Floor-Mounted Piping, Seismic Applications: Use seismic type restrained spring isolators.
 - 7. Use modular seal or approved resilient material where vibration-isolated piping penetrates building elements (e.g., walls, floors) arranged to prevent vibration transmission to structure.
- F. Thrust Restraint Applications:
 - 1. Use thrust restraints to resist horizontal motion due to thrust for fan heads, suspended fans, and base-mounted and suspended air handling equipment operating at 2.0 inches wg or greater total static pressure.
 - 2. Minimum Static Deflection: Same as static deflection of equipment.
 - 3. Limit lateral movement to 0.25 inch or less unless otherwise indicated.

2.02 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

- A. Manufacturers:
 - 1. Vibration-Isolated Equipment Support Bases:
 - a. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
 - b. Mason Industries: www.mason-ind.com/#sle.

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- c. Vibration Eliminator Company, Inc: www.veco-nyc.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Vibration-Isolated Structural Steel Bases:
- 1. Description: Engineered structural steel frames with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.
- C. Vibration-Isolated Concrete Inertia Bases:
- 1. Description: Concrete-filled engineered steel forms with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.
 - 2. Minimum Base Depth: 6 inches.
 - 3. Minimum Base Mass (Including Concrete): 1.5 times weight of supported equipment.
 - 4. Concrete Reinforcement: Welded or tied reinforcing bars running both ways in a single layer.
 - 5. Concrete: Filled on site with minimum 3000 psi concrete in accordance with Section 03 30 00.

2.03 VIBRATION ISOLATORS

- A. Manufacturers:
- 1. Vibration Isolators:
 - a. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
 - b. Mason Industries: www.mason-ind.com/#sle.
 - c. Vibration Eliminator Company, Inc: www.veco-nyc.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- B. General Requirements:
- 1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
 - 2. Spring Elements for Spring Isolators:
 - a. Color code or otherwise identify springs to indicate load capacity.
 - b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
 - c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
 - d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
 - e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
 - f. Selected to function without undue stress or overloading.
 - 3. Seismic Snubbing Elements for Seismic Isolators:
 - a. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
 - b. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.
- C. Vibration Isolators for Seismic Applications:
- 1. Resilient Material Isolator Mounts, Seismic:
 - a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) isolator material; specifically designed and rated for seismic applications with integral snubbing in all directions.
 - b. Products:
 - 1) Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Restrained Spring Isolators, Seismic:
 - a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) in series with elastomeric (e.g., neoprene, rubber) isolator material within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop; specifically designed and rated for seismic applications with integral snubbing in all directions.
 - b. Bottom Load Plate: Steel with provisions for bolting to supporting structure as required.
 - c. Furnished with integral leveling device for positioning and securing supported equipment.
 - d. Provides constant free and operating height.
 - e. Products:
 - 1) Substitutions: See Section 01 60 00 - Product Requirements.
 - 3. Resilient Material Isolator Hangers, Seismic:
 - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) isolator material for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
 - b. Products:

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4. Spring Isolator Hangers, Seismic:
 - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
 - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
 - c. Products:
 - 1) Substitutions: See Section 01 60 00 - Product Requirements.
5. Combination Resilient Material/Spring Isolator Hangers, Seismic:
 - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g., neoprene, rubber) isolator material for the upper hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
 - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
 - c. Products:
 - 1) Substitutions: See Section 01 60 00 - Product Requirements.

2.04 ACOUSTICAL AND VIBRATION ISOLATORS

- A. Manufacturers:
 1. Acoustical and Vibration Isolators:
 - a. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 2. Source Limitations: Furnish isolators and associated accessories produced by a single manufacturer and obtained from a single supplier.
- B. General Requirements:
 1. Acoustical Isolation System: Through-stud isolators, pipe clamps, riser clamp pads, neoprene and felt lining material and associated support brackets.

2.05 EXTERNAL SEISMIC SNUBBER ASSEMBLIES

- A. Manufacturers:
 1. External Seismic Snubber Assemblies:
 - a. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
 - b. Mason Industries: www.mason-ind.com/#sle.
 - c. Vibration Eliminator Company, Inc: www.veco-nyc.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 2. Source Limitations: Furnish external seismic snubber assemblies and associated accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.
- B. Description: Steel snubbing assemblies designed for external attachment to both equipment and supporting structure that, as part of a complete system, restrain equipment motion in all directions during a seismic event while maintaining vibration isolation during normal operation.
- C. Seismic Snubbing Elements:
 1. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
 2. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.
- D. Products:
 1. Substitutions: See Section 01 60 00 - Product Requirements.

2.06 SEISMIC RESTRAINT SYSTEMS

- A. Manufacturers:
 1. Seismic Restraint Systems:
 - a. AFCON, a brand of Anvil International: www.anvilintl.com/#sle.
 - b. Eaton Corporation: www.eaton.com/#sle.
 - c. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
 - d. Mason Industries: www.mason-ind.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.

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- B. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.
- C. Cable Restraints:
 - 1. Comply with ASCE 19.
 - 2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
 - 3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
 - 4. Use protective thimbles for cable loops where potential for cable damage exists.
- D. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

2.07 VIBRATION-ISOLATED AND/OR SEISMICALLY ENGINEERED ROOF CURBS

- A. Manufacturers:
 - 1. Vibration-Isolated and/or Seismically Engineered Roof Curbs:
 - a. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
 - b. Mason Industries: www.mason-ind.com/#sle.
 - c. Vibration Eliminator Company, Inc: www.veco-nyc.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Vibration Isolation Curbs:
 - 1. Seismic Curb:
 - a. Location: Between structure and rooftop equipment.
 - b. Construction: Steel.
 - c. Integral vibration isolation to comply with requirements of this section.
 - d. Snubbers consist of minimum 0.25 inch thick resilient pads to avoid metal-to-metal contact without compromising vibration isolating capabilities.
 - e. Weather exposed components consist of corrosion resistant materials.
- C. Seismic Type Nonisolated Curb and Fabricated Equipment Piers:
 - 1. Location: Between structure and rooftop equipment.
 - 2. Construction: Steel.
 - 3. Weather exposed components consist of corrosion resistant materials.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 CODE-REQUIRED SPECIAL INSPECTIONS

- A. Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner or Architect in accordance with Section 01 45 33 and statement of special inspections as required by applicable building code.
- B. Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.
 - 1. Continuous Special Inspections: Special Inspection Agency 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 Inspections: Special Inspection Agency 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.
- C. Seismic special inspections include, but are not limited to:
 - 1. Seismically Qualified Equipment: Verification that label, anchorage, and mounting comply with the certificate of compliance.
 - 2. Installation and anchorage of piping systems designed to carry hazardous materials and their associated mechanical units for Seismic Design Categories C, D, E, and F; periodic inspection.
 - 3. Installation and anchorage of ductwork designed to carry hazardous materials for Seismic Design Categories C, D, E and F; periodic inspection.

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4. Installation and anchorage of vibration isolation systems for Seismic Design Categories C, D, E, and F where the approved Contract Documents require a nominal clearance of 1/4 inch or less between equipment support frame and seismic restraint; periodic inspection.
 5. Verification of required clearances between HVAC equipment, distribution systems, and associated supports and fire protection sprinkler system drops and sprigs for Seismic Design Categories C, D, E, and F; periodic inspection.
- D. Prior to starting work, Contractor to submit written statement of responsibility to authorities having jurisdiction and to Owner acknowledging awareness of special requirements contained in the statement of special inspections.
- E. Special Inspection Agency services do not relieve Contractor from performing inspections and testing specified elsewhere.

3.03 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Secure fasteners according to manufacturer's recommended torque settings.
- D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.
- E. Vibration Isolation Systems:
1. Vibration-Isolated Equipment Support Bases:
 - a. Provide specified minimum clearance beneath base.
 2. Spring Isolators:
 - a. Position equipment at operating height; provide temporary blocking as required.
 - b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
 - c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
 3. Isolator Hangers:
 - a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
 - b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
 4. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
 5. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
 6. Adjust isolators to be free of isolation short circuits during normal operation.
 7. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.
- F. Seismic Controls:
1. Provide specified snubbing element air gap; remove any factory-installed spacers, debris, or other obstructions.
 2. Use only specified components, anchorage, and hardware evaluated by seismic design. Comply with conditions of seismic certification where applicable.
 3. Where mounting hole diameter exceeds bolt diameter by more than 0.125 inch, use epoxy grout, elastomeric grommet, or welded washer to reduce clearance to 0.125 inch or less.
 4. Equipment with Sheet Metal Housings:
 - a. Use Belleville washers to distribute stress over a larger surface area of the sheet metal connection interface as approved by manufacturer.
 - b. Attach additional steel as approved by manufacturer where required to transfer loads to structure.
 - c. Where mounting surface is irregular, do not shim housing; reinforce housing with additional steel as approved by manufacturer.
 5. Concrete Housekeeping Pads:
 - a. Size in accordance with seismic design to meet anchor requirements.
 - b. Install pad reinforcement and doweling in accordance with seismic design to ensure integrity of pad and associated connection to slab.
 6. Seismic Restraint Systems:
 - a. Do not attach seismic restraints and gravity supports to dissimilar parts of structure that may move differently during an earthquake.
 - b. Install restraints within permissible angles in accordance with seismic design.

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- c. Install cable restraints straight between component/run and structural attachment; do not bend around other nonstructural components or structural elements.
- d. Install cable restraints for vibration-isolated components slightly slack to prevent short-circuiting of isolation.
- e. Install hanger rod stiffeners where indicated using only specified clamps; do not weld stiffeners to hanger rod.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect vibration isolation and/or seismic control components for damage and defects.
- C. Provide manufacturer representative or authorized technician services to assist with inspection and testing of vibration isolation systems and seismic controls. Submit a detailed copy of manufacturer recommended inspection, testing, and field report procedures.
- D. Vibration Isolation Systems:
 - 1. Verify isolator static deflections.
 - 2. Verify required clearance beneath vibration-isolated equipment support bases.
 - 3. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.
- E. Seismic Controls:
 - 1. Verify snubbing element air gaps.
- F. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.
- G. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION

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SECTION 230553 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Adhesive-backed duct markers.
- D. Stencils.
- E. Pipe markers.
- F. Ceiling tacks.

1.02 RELATED REQUIREMENTS

- A. Section 09 91 23 - Interior Painting: Identification painting.

1.03 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.
- B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Product Data: Provide manufacturers catalog literature for each product required.
- E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
- F. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Air Handling Units: Nameplates.
- B. Air Terminal Units: Tags.
- C. Control Panels: Nameplates.
- D. Dampers: Ceiling tacks, where located above lay-in ceiling.
- E. Ductwork: Nameplates.
- F. Heat Transfer Equipment: Nameplates.
- G. Piping: Tags.
- H. Pumps: Nameplates.
- I. Tanks: Nameplates.
- J. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.02 NAMEPLATES

- A. Manufacturers:
 - 1. Advanced Graphic Engraving, LLC: www.advancedgraphicengraving.com/#sle.
 - 2. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 - 4. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.

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- B. Letter Color: White.
- C. Letter Height: 1/4 inch.
- D. Background Color: Black.
- E. Plastic: Comply with ASTM D709.

2.03 TAGS

- A. Manufacturers:
 - 1. Advanced Graphic Engraving; _____: www.advancedgraphicengraving.com/#sle.
 - 2. Brady Corporation; _____: www.bradycorp.com/#sle.
 - 3. Brimar Industries, Inc; _____: www.pipemarker.com/#sle.
 - 4. Kolbi Pipe Marker Co; _____: www.kolbipipemarkers.com/#sle.
 - 5. Seton Identification Products, a Tricor Company; _____: www.seton.com/#sle.
 - 6. Substitutions: See Section 01 60 00 - 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 ADHESIVE-BACKED DUCT MARKERS

- A. Manufacturers:
 - 1. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - 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: Yellow/Black.

2.05 STENCILS

- A. Manufacturers:
 - 1. Brady Corporation: www.bradycorp.com/#sle.
 - 2. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 - 3. Seton Identification Products, a Tricor Company: www.seton.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Stencils: With clean cut symbols and letters of following size:
 - 1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
- C. Stencil Paint: As specified in Section 09 91 23, semi-gloss enamel, colors complying with ASME A13.1.

2.06 PIPE MARKERS

- A. Manufacturers:
 - 1. Brady Corporation: www.bradycorp.com/#sle.
 - 2. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 - 4. Seton Identification Products, a Tricor Company: www.seton.com/#sle.
- B. Color: Comply with ASME A13.1.
- C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- D. Underground Plastic Pipe Markers: Bright-colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil, 0.004 inch thick, manufactured for direct burial service.
- E. 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.

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2.07 CEILING TACKS

- A. Manufacturers:
 - 1. Craftmark: www.craftmarkid.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: Steel with 3/4 inch diameter color coded head.
- C. Color code as follows:
 - 1. HVAC Equipment: Yellow.
 - 2. Fire Dampers and Smoke Dampers: Red.
 - 3. Heating/Cooling Valves: Blue.

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. Apply stencil painting in accordance with Section 09 91 23.
- D. Install plastic pipe markers in accordance with manufacturer's instructions.
- E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- G. Use tags on piping 3/4 inch diameter and smaller.
 - 1. Identify service, flow direction, and pressure.
 - 2. Install in clear view and align with axis of piping.
 - 3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- H. Install ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
- I. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

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SECTION 230593 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 steam systems.
- C. Measurement of final operating condition of HVAC systems.
- D. Sound measurement of equipment operating conditions.
- E. Commissioning activities.

1.02 RELATED REQUIREMENTS

- A. Section 01 91 13 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.
- B. Section 23 08 00 - Commissioning of HVAC.

1.03 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; 2008, with Errata (2019).
- C. NEBB (TAB) - Procedural Standard for Testing Adjusting and Balancing of Environmental Systems; 2019.
- D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2023.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.
- C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
 - 1. Submit to Architect.
 - 2. Submit to the Commissioning Authority.
 - 3. Submit six weeks prior to starting the testing, adjusting, and balancing work.
 - 4. Include certification that the plan developer has reviewed Contract Documents, the equipment and systems, and the control system with the Architect and other installers to sufficiently understand the design intent for each system.
 - 5. Include at least the following in the plan:
 - a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
 - b. 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.
 - c. Identification and types of measurement instruments to be used and their most recent calibration date.
 - d. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
 - e. Final test report forms to be used.
 - f. Detailed step-by-step procedures for TAB work for each system and issue, including:
 - 1) Terminal flow calibration (for each terminal type).
 - 2) Diffuser proportioning.
 - 3) Branch/submain proportioning.
 - 4) Total flow calculations.
 - 5) Rechecking.
 - 6) Diversity issues.
 - g. Details of how TOTAL flow will be determined; for example:

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- 1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
 - 2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.
 - h. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
 - i. Method of checking building static and exhaust fan and/or relief damper capacity.
 - j. Proposed selection points for sound measurements and sound measurement methods.
 - k. Time schedule for deferred or seasonal TAB work, if specified.
 - l. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
 - m. Procedures for formal deficiency reports, including scope, frequency and distribution.
- D. 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.
- E. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
1. Submit to the the Commissioning Authority within two weeks after completion of testing, adjusting, and balancing.
 2. Revise TAB plan to reflect actual procedures and submit as part of final report.
 3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
 4. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
 5. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
 6. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
 7. Units of Measure: Report data in I-P (inch-pound) units only.
 8. Include the following on the title page of each report:
 - a. Name of Testing, Adjusting, and Balancing Agency.
 - b. Address of Testing, Adjusting, and Balancing Agency.
 - c. Telephone number of Testing, Adjusting, and Balancing Agency.
 - d. Project name.
 - e. Project location.
 - f. Project Architect.
 - g. Project Engineer.
 - h. Project Contractor.
 - i. Project altitude.
 - j. Report date.

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. SMACNA (TAB).
 3. 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:

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- a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
 - 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.
- F. Pre-Qualified TAB Agencies:
1. JEDI Balancing, Inc..
 2. Certified Balance, Inc..
 3. .

3.02 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
1. Systems are started and operating in a safe and normal condition.
 2. Temperature control systems are installed complete and operable.
 3. Proper thermal overload protection is in place for electrical equipment.
 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 5. Duct systems are clean of debris.
 6. Fans are rotating correctly.
 7. Fire and volume dampers are in place and open.
 8. Air coil fins are cleaned and combed.
 9. Access doors are closed and duct end caps are in place.
 10. Air outlets are installed and connected.
 11. Duct system leakage is minimized.
 12. Hydronic systems are flushed, filled, and vented.
 13. Pumps are rotating correctly.
 14. Proper strainer baskets are clean and in place.
 15. Service and balance valves are open.
- B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.
- C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

- A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

3.04 ADJUSTMENT TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- B. 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.
- C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.
- D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

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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 extent 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. 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.
- H. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- I. 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.
- J. 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.
- K. 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.
- L. 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.

3.08 COMMISSIONING

- A. See Sections 01 91 13 - General Commissioning Requirements and 23 08 00 for additional requirements.
- B. Perform prerequisites prior to starting commissioning activities.
- C. Fill out Prefunctional Checklists for:
 - 1. Air side systems.
 - 2. Water side systems.
- D. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.
- E. Re-check minimum outdoor air intake flows and maximum and intermediate total airflow rates for 100 percent of the air handlers plus a random sample equivalent to 100 percent of the final TAB report data as directed by Commissioning Authority.
 - 1. Original TAB agency shall execute the re-checks, witnessed by the Commissioning Authority.
 - 2. Use the same test instruments as used in the original TAB work.

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3. Failure of more than 10 percent of the re-checked items of a given system shall result in the rejection of the system TAB report; rebalance the system, provide a new system TAB report, and repeat random re-checks.
 4. For purposes of re-check, failure is defined as follows:
 - a. Air Flow of Supply and Return: Deviation of more than 10 percent of instrument reading.
 - b. Minimum Outside Air Flow: Deviation of more than 20 percent of instrument reading; for inlet vane or VFD OSA compensation system using linear proportional control, deviation of more than 30 percent at intermediate supply flow.
 - c. Temperatures: Deviation of more than one degree F.
 - d. Air and Water Pressures: Deviation of more than 10 percent of full scale of test instrument reading.
 - e. Sound Pressures: Deviation of more than 3 decibels, with consideration for variations in background noise.
 5. For purposes of re-check, a whole system is defined as one in which inaccuracies will have little or no impact on connected systems; for example, the air distribution system served by one air handler or the hydronic chilled water supply system served by a chiller or the condenser water system.
- F. In the presence of the Commissioning Authority, verify that:
1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.
 2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.
 3. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90 percent or more open.

3.09 SCOPE

- A. Test, adjust, and balance the following:
1. HVAC Pumps.
 2. Water Tube Boilers.
 3. Packaged Steel Water Tube Boilers.
 4. Packaged Steel Fire Tube Boilers.
 5. Forced Air Furnaces.
 6. Air Cooled Water Chillers.
 7. Centrifugal Water Chillers.
 8. Induced Draft Cooling Tower.
 9. Blow Through Cooling Tower.
 10. Air Cooled Refrigerant Condensers.
 11. Packaged Roof Top Heating/Cooling Units.
 12. Packaged Terminal Air Conditioning Units.
 13. Unit Air Conditioners.
 14. Computer Room Air Conditioning Units.
 15. Air Coils.
 16. Terminal Heat Transfer Units.
 17. Air Handling Units.
 18. Fans.
 19. Air Filters.
 20. Air Terminal Units.
 21. Air Inlets and Outlets.

3.10 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.

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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.
- 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. Air Cooled Condensers:
1. Identification/number.
 2. Location.
 3. Manufacturer.
 4. Model number.
 5. Serial number.
- E. 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.
- F. Cooling Tower:
1. Tower identification/number.
 2. Manufacturer.
 3. Model number.
 4. Serial number.
 5. Rated capacity.
 6. Entering air WB temperature, specified and actual.
 7. Leaving air WB temperature, specified and actual.
 8. Ambient air DB temperature.
 9. Condenser water entering temperature.
 10. Condenser water leaving temperature.
 11. Condenser water flow rate.
 12. Fan RPM.
- G. Heat Exchangers:
1. Identification/number.
 2. Location.
 3. Service.
 4. Manufacturer.
 5. Model number.

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6. Serial number.
 7. Primary water entering temperature, design and actual.
 8. Primary water leaving temperature, design and actual.
 9. Primary water flow, design and actual.
 10. Primary water pressure drop, design and actual.
 11. Secondary water leaving temperature, design and actual.
 12. Secondary water flow, design and actual.
 13. Secondary water pressure drop, design and actual.
- H. 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. Water flow, design and actual.
 11. Water pressure drop, design and actual.
 12. Entering water temperature, design and actual.
 13. Leaving water temperature, design and actual.
 14. Saturated suction temperature, design and actual.
 15. Air pressure drop, design and actual.
- I. 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.
- J. Electric Duct Heaters:
1. Manufacturer.
 2. Identification/number.
 3. Location.
 4. Model number.
 5. Design kW.
 6. Number of stages.
 7. Phase, voltage, amperage.
 8. Test voltage (each phase).
 9. Test amperage (each phase).
 10. Air flow, specified and actual.
 11. Temperature rise, specified and actual.
- K. 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.

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11. Discharge pressure.
 12. Sheave Make/Size/Bore.
 13. Number of Belts/Make/Size.
 14. Fan RPM.
- L. 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.
- M. Duct Traverses:
1. System zone/branch.
 2. Duct size.
 3. Area.
 4. Design velocity.
 5. Design air flow.
 6. Test velocity.
 7. Test air flow.
 8. Duct static pressure.
 9. Air temperature.
 10. Air correction factor.
- N. 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.
- O. Air Distribution Tests:
1. Air terminal number.
 2. Room number/location.
 3. Terminal type.
 4. Terminal size.
 5. Design air flow.
 6. Test (final) air flow.
 7. Percent of design air flow.
- P. Sound Level Reports:
1. Location.
 2. Octave bands - equipment off.
 3. Octave bands - equipment on.

END OF SECTION

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SECTION 230713 DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Duct insulation.
- B. Duct liner.
- C. Jacketing and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 23 05 53 - Identification for HVAC Piping and Equipment.
- B. Section 23 31 00 - HVAC Ducts and Casings: Glass fiber ducts.

1.03 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; 2013 (Reapproved 2019).
- C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).
- D. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2020.
- E. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2019.
- F. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts; 2016 (Reapproved 2021).
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).
- I. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).
- J. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.
- K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.05 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.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

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1.07 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. Johns Manville: www.jm.com/#sle.
 - 2. Knauf Insulation; Atmosphere Duct Wrap: www.knaufinsulation.com/#sle.
 - 3. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Insulation: ASTM C553; flexible, noncombustible blanket.
 - 1. K value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
 - 2. Maximum Service Temperature: 1,200 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.
- E. Outdoor Vapor Barrier Mastic:
 - 1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
- F. Tie Wire: Annealed steel, 16 gauge, 0.0508 inch diameter.

2.03 GLASS FIBER, RIGID

- A. Manufacturer:
 - 1. Johns Manville: www.jm.com/#sle.
 - 2. Knauf Insulation: www.knaufinsulation.com/#sle.
 - 3. Owens Corning Corporation; 700 Series FIBERGLAS Insulation: www.ocbuildingspec.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - 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.
- E. Indoor Vapor Barrier Finish:
 - 1. Cloth: Untreated; 9 oz/sq yd weight, glass fabric.
 - 2. Vinyl emulsion type acrylic, compatible with insulation, black color.

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2.04 JACKETING AND ACCESSORIES

- A. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire-retardant lagging adhesive.
 - 1. Lagging Adhesive:
 - a. Compatible with insulation.
- B. Mineral Fiber (Outdoor) Jacket: Asphalt impregnated and coated sheet, 50 lb/square.
- C. Aluminum Jacket:
 - 1. Thickness: 0.016 inch sheet.
 - 2. Finish: Embossed.
 - 3. Joining: Longitudinal slip joints and 2 inch laps.
 - 4. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.
 - 5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.
 - 6. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

2.05 DUCT LINER

- A. Manufacturers:
 - 1. Johns Manville: www.jm.com/#sle.
 - 2. Knauf Insulation: www.knaufinsulation.com/#sle.
 - 3. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
- B. Glass Fiber 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. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.
 - 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.
- C. Adhesive: Waterproof, fire-retardant type, ASTM C916.
- D. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

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. Insulated Ducts Conveying Air Below Ambient Temperature:
 - 1. Provide insulation with vapor barrier jackets.
 - 2. Finish with tape and vapor barrier jacket.
 - 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 - 4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- C. Insulated Ducts Conveying Air Above Ambient Temperature:
 - 1. Provide with or without standard vapor barrier jacket.
 - 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- D. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor): Finish with canvas jacket sized for finish painting.
- E. Exterior Applications: Provide insulation with vapor barrier jacket. Cover with with calked aluminum jacket with seams located on bottom side of horizontal duct section.

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- F. External Duct Insulation Application:
 - 1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
 - 2. Secure insulation without vapor barrier with staples, tape, or wires.
 - 3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
 - 4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
 - 5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
- G. Duct and Plenum Liner Application:
 - 1. Adhere insulation with adhesive for 90 percent coverage.
 - 2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
 - 3. Seal and smooth joints. Seal and coat transverse joints.
 - 4. Seal liner surface penetrations with adhesive.
 - 5. Duct dimensions indicated are net inside dimensions required for air-flow. Increase duct size to allow for insulation thickness.

3.03 SCHEDULES

- A. Combustion Air Duct:
 - 1. Flexible Glass Fiber Duct Insulation: 1/2" thick flexible glass fiber duct wrap.
- B. Exhaust Ducts Within 10 ft of Exterior Openings: 1/2" thick flexible glass fiber duct wrap.
- C. Outside Air Intake Ducts: 1" thick flexible cellular glass fiber duct wrap.
- D. Plenums: Lined with fiberglass duct liner with reinforced coating system. Liner to have minimum manufacturer's "as installed" R value of R-6 or greater.
- E. Supply and Return Ducts (where located in unconditioned spaces; includes crawlspaces both ventilated and unventilated): Wrapped with flexible glass fiber duct wrap or lined with flexible glass duct liner with reinforced coating system as noted on the contract drawings. Insulation to have "as installed" manufacturer's minimum R value of R-6 or greater.
- F. Supply and Return Ducts (where located in indirectly conditioned spaces and includes return air plenums with or without exposed roofs above): Lined with 1" flexible glass duct liner with reinforced coating system as noted on the contract drawings.
- G. Supply ducts After Terminal Boxes: Where located in unconditioned spaces; includes crawlspaces both ventilated and unventilated: Wrapped with flexible glass fiber duct wrap or lined with flexible glass duct liner with reinforced coating system as noted on the contract drawings. Insulation to have "as installed" manufacturer's minimum R value of R-6 or greater. Where located in indirectly conditioned spaces and includes return air plenums with or without exposed roofs above: Lined with 1" flexible glass duct liner with reinforced coating system as noted on the contract drawings.
- H. Ducts Exposed to Outdoors: Wrapped with flexible glass fiber duct wrap or lined with flexible glass duct liner with reinforced coating system as noted on the contract drawings. Insulation to have "as installed" manufacturer's minimum R value of R-12 or greater. Duct to have aluminum jacket sealed weathertight.

END OF SECTION

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SECTION 230716 HVAC EQUIPMENT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Equipment insulation.
- B. Jacketing and accessories.
- C. Breeching insulation.

1.02 RELATED REQUIREMENTS

- A. Section 23 05 53 - Identification for HVAC Piping and Equipment.
- B. Section 23 21 13 - Hydronic Piping: Placement of hangers and hanger inserts.
- C. Section 23 23 00 - Refrigerant Piping: Placement of inserts.

1.03 REFERENCE STANDARDS

- A. 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).
- B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2019).
- C. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2019).
- D. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.
- E. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2017 (Reapproved 2023).
- F. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2022.
- G. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).
- H. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2022a.
- I. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).
- J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- K. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).
- L. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for equipment scheduled.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

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

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- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum 3 years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 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. Manufacturers:
 - 1. CertainTeed Corporation: www.certainteed.com/#sle.
 - 2. Johns Manville Corporation: www.jm.com/#sle.
 - 3. Knauf Insulation; Atmosphere Duct Wrap: www.knaufinsulation.com/#sle.
 - 4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Insulation: ASTM C553; flexible, noncombustible.
 - 1. K Value: 0.36 at 75 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
 - 2. Maximum Service Temperature: 1,000 degrees F.
 - 3. Maximum Water Vapor Absorption: 5.0 percent by weight.
- C. Vapor Barrier Jacket: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
 - 1. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
 - 2. Secure with self-sealing longitudinal laps and butt strips.
- D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- E. Vapor Barrier Lap Adhesive: Compatible with insulation.
- F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

2.03 GLASS FIBER, RIGID

- A. Manufacturer:
 - 1. CertainTeed Corporation: www.certainteed.com/#sle.
 - 2. Johns Manville Corporation: www.jm.com/#sle.
 - 3. Knauf Insulation; Earthwool Insulation Board: www.knaufinsulation.com/#sle.
 - 4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Insulation: ASTM C612 or ASTM C592; rigid, noncombustible.
 - 1. K Value: 0.25 at 75 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
 - 2. Maximum Service Temperature: 1,200 degrees F.
 - 3. Maximum Water Vapor Absorption: 5.0 percent by weight.
 - 4. Maximum Density: 8.0 pcf.
- C. Vapor Barrier Jacket:
 - 1. Kraft paper reinforced 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 self-sealing longitudinal laps and butt strips.
- D. Facing: 1 inch galvanized steel hexagonal wire mesh stitched on one face of insulation.

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- E. Vapor Barrier Lap Adhesive: Compatible with insulation.
- F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

2.04 CELLULAR GLASS

- A. Manufacturer:
 - 1. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Pipe and Tubing Insulation: ASTM C552, Type II, Grade 6.
 - 1. K Value: 0.35 at 100 degrees F.
 - 2. Service Temperature Range: From 250 degrees F to 800 degrees F.
 - 3. Water Vapor Permeability: 0.005 perm inch maximum per inch.
 - 4. Water Absorption: 0.5 percent by volume, maximum.
 - 5. Density: At least 6.12 pcf, minimum.
- C. Block Insulation: ASTM C552, Type I, Grade 6.

2.05 HYDROUS CALCIUM SILICATE

- A. Manufacturer:
 - 1. Johns Manville Corporation: www.jm.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Insulation: ASTM C533; rigid molded, asbestos free, gold color.
 - 1. K Value: 0.40 at 300 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
 - 2. Maximum Service Temperature: 1,200 degrees F.
 - 3. Density: 15 pcf.
- C. Tie Wire: 0.048 inches stainless steel with twisted ends on maximum 12 inch centers.
- D. Insulating Cement: ASTM C449.

2.06 JACKETING AND ACCESSORIES

- A. PVC Plastic:
 - 1. Manufacturers:
 - a. Johns Manville Corporation: www.jm.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Jacket: Sheet material, off-white color.
 - a. Minimum Service Temperature: Minus 40 degrees F.
 - b. Maximum Service Temperature: 150 degrees F.
 - c. Moisture Vapor Permeability: 0.02 perm inch, 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. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire-retardant lagging adhesive.
 - 1. Lagging Adhesive: Compatible with insulation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that equipment 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. Factory Insulated Equipment: Do not insulate.
- C. Exposed Equipment: Locate insulation and cover seams in least visible locations.

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- D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
- E. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.
- F. Fiber glass insulated equipment containing fluids below ambient temperature; provide vapor barrier jackets, factory-applied or field-applied. Finish with glass cloth and vapor barrier adhesive.
- G. For hot equipment containing fluids 140 degrees F or less, do not insulate flanges and unions, but bevel and seal ends of insulation.
- H. For hot equipment containing fluids over 140 degrees F, insulate flanges and unions with removable sections and jackets.
- I. Fiber glass insulated equipment containing fluids above ambient temperature; provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Finish with glass cloth and adhesive.
- J. Inserts and Shields:
 - 1. Application: Equipment 1-1/2 inches diameter or larger.
 - 2. Shields: Galvanized steel between hangers and inserts.
 - 3. Insert Location: Between support shield and equipment and under the finish jacket.
 - 4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 - 5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- K. Finish insulation at supports, protrusions, and interruptions.
- L. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with canvas jacket sized for finish painting.
- M. Exterior Applications:
 - 1. Provide vapor barrier jacket or finish with glass mesh reinforced vapor barrier cement.
 - 2. Cover with {CH#127328}.
- N. Cover glass fiber insulation with metal mesh and finish with heavy coat of insulating cement.
- O. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.
- P. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

3.03 SCHEDULE

- A. Heating Systems:
 - 1. Pump Bodies:
 - 2. Heat Exchangers/Converters:
 - 3. Air Separators:
 - 4. Hot Thermal Storage Tanks:
 - 5. Condensate Tanks:
 - 6. Flue Gas Breeching:
- B. Cooling Systems:
 - 1. Pump Bodies:
 - 2. Air Separators:
 - 3. Cold Thermal Storage Tanks:

END OF SECTION

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SECTION 230719 HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping insulation.
- B. Flexible removable and reusable blanket insulation.
- C. Jacketing and accessories.
- D. Engineered wall outlet seals and refrigerant piping insulation protection.

1.02 RELATED REQUIREMENTS

- A. Section 07 84 00 - Firestopping.
- B. Section 23 21 13 - Hydronic Piping: Placement of hangers and hanger inserts.
- C. Section 23 23 00 - Refrigerant Piping: Placement of inserts.

1.03 REFERENCE STANDARDS

- A. 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).
- B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2019).
- C. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2019).
- D. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.
- E. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2017 (Reapproved 2023).
- F. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.
- G. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.
- H. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).
- I. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).
- J. ASTM C1695 - Standard Specification for Fabrication of Flexible Removable and Reusable Blanket Insulation for Hot Service; 2022.
- K. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 2022.
- L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- M. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).
- N. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).
- O. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.
- P. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).
- Q. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013 (Reapproved 2021).
- R. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

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- S. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

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.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum 3 years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 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, FLEXIBLE

- A. Manufacturers:
 - 1. JP Lamborn Co; Thermal Sleeve MT: www.jpflex.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Insulation: ASTM C553; flexible, noncombustible blanket.
 - 1. K Value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
 - 2. Maximum Service Temperature: 1,200 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.
- E. Outdoor Vapor Barrier Mastic:
 - 1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
- F. Tie Wire: Annealed steel, 16 gauge, 0.0508 inch diameter.

2.03 GLASS FIBER, RIGID

- A. Manufacturers:
 - 1. CertainTeed Corporation: www.certainteed.com/#sle.
 - 2. Johns Manville Corporation: www.jm.com/#sle.
 - 3. Knauf Insulation; Earthwool 1000 Degree Pipe Insulation: www.knaufinsulation.com/#sle.
 - 4. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: www.ocbuildingspec.com/#sle.
 - 5. Owens Corning Corporation; VaporWick Pipe Insulation: www.ocbuildingspec.com/#sle.
 - 6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.

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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-inches.
- D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- E. Vapor Barrier Lap Adhesive: Compatible with insulation.
- F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
- G. Fibrous Glass Fabric:
1. Cloth: Untreated; 9 oz/sq yd weight.
 2. Blanket: 1.0 pcf density.
 3. Weave: 5 by 5.
- H. Indoor Vapor Barrier Finish:
1. Cloth: Untreated; 9 oz/sq yd weight.
 2. Vinyl emulsion type acrylic, compatible with insulation, black color.
- I. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
- J. Insulating Cement: ASTM C449.

2.04 FLEXIBLE REMOVABLE AND REUSABLE BLANKET INSULATION

- A. Manufacturers:
1. Auburn Manufacturing Inc; Ever Green Cut 'n Wrap: www.auburnmfg.com/#sle.
 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Insulation: ASTM C553 Type V; flexible, noncombustible.
1. Comply with ASTM C1695.
 2. K Value: 0.37 at 100 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
 3. Minimum Service Temperature: 32 degrees F.
 4. Maximum Service Temperature: 500 degrees F.
 5. Maximum Water Vapor Absorption: 5.0 percent by weight.
 6. Color: Gray, Green.
 7. Weight: 7.65 oz/sq ft.
 8. Effective Thickness: 1.25 +/- 0.25 inch.

2.05 HYDROUS CALCIUM SILICATE

- A. Manufacturers:
1. Johns Manville Corporation; _____: www.jm.com/#sle.
 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Insulation: ASTM C533 and ASTM C795; rigid molded, asbestos free, gold color.
1. K Value: 0.40 at 300 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
 2. Maximum Service Temperature: 1200 degrees F.
 3. Density: 15 pcf.
- C. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- D. Insulating Cement: ASTM C449.

2.06 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturers:
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
1. Minimum Service Temperature: Minus 40 degrees F.
 2. Maximum Service Temperature: 180 degrees F.
 3. Connection: Waterproof vapor barrier adhesive.
- C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.07 JACKETING AND ACCESSORIES

- A. PVC Plastic.

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1. Manufacturers:
 - a. Johns Manville Corporation: www.jm.com/#sle.
 - b. Substitutions: See Section 01 60 00 - 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. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire-retardant lagging adhesive.
1. Lagging Adhesive: Compatible with insulation.

2.08 ENGINEERED WALL OUTLET SEALS AND REFRIGERANT PIPING INSULATION PROTECTION

- A. Manufacturers:
1. Airex Manufacturing, Inc; ____: www.airexmf.com/#sle.
 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Basis of Design: Airex Manufacturing, Inc; www.airexmf.com/#sle.
1. Pipe Penetration Wall Seal: Airex Titan Outlet.
 2. Refrigeration Pipe Insulation Protection System: Airex E-Flex Guard.
 3. Pipe Penetration Wall Seal and Insulation Protection System: Airex Pro-System Kit.
- C. Pipe Penetration Wall Seal: Seals HVAC piping wall penetrations with compression gasket wall mounted rigid plastic outlet cover.
1. Wall Outlet Size, Stucco and Masonry Applications: 7-1/2 inch wide by 10 inch high.
 - a. Elastomeric Sleeve Diameter: 1-11/16 inch.
 2. Wall Outlet Size, Siding and Compact Applications: 6-7/8 inch wide by 3-7/8 inch high.
 - a. Elastomeric Sleeve Diameter: 1-11/16 inch.
 3. Outlet Cover Color: Gray.
 4. Water Penetration: Comply with ASTM E331.
 5. Air Leakage: Comply with ASTM E283.
 6. Air Permeance: Comply with ASTM E2178.
- D. Insulation Protection System: Refrigerant piping insulation PVC protective cover.
1. PVC Insulation Cover Color: Black with full-length velcro fastener.
 2. Weatherization and Ultraviolet Exposure Protection: Comply with ASTM G153.
 3. Water/Vapor Permeability: Comply with ASTM E96/E96M.
 4. Anti-Fungal and Anti-Microbial Resistance: Comply with ASTM G21.
 5. Flame Spread and Smoke Development Rating of 24/450: Comply with ASTM E84 or UL 723.
 6. Water Absorption of Plastics: Comply with ASTM D570.
 7. Adhesive free.

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. Exposed Piping: Locate insulation and cover seams in least visible locations.
- C. Insulated Pipes Conveying Fluids Below Ambient Temperature:
 1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- D. 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.

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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.
- E. 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.
- F. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.
- G. 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.
- H. Inserts and Shields:
 1. Application: Piping 1-1/2 inches diameter or larger.
 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 3. Insert location: Between support shield and piping and under the finish jacket.
 4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 07 84 00.
- J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with ASJ vapor retarder jacket and longitudinal self sealing closure.
- K. 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.
- L. Buried Piping: Provide factory-fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with 1 mil, 0.001 inch thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with polyester film.
- M. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.03 SCHEDULE

- A. Heating Systems:
 1. Heating Water Supply and Return: Fluid range: 105-140 deg F - less than 1.5" diameter: 1" rigid glass fiber, 2" and greater diameter piping: 1.5" rigid glass fiber. Fluid range: 141-200 deg F - less than 1.5" diameter: 1.5" rigid glass fiber, 2" and greater diameter piping: 2" rigid glass fiber.
 2. Low Pressure Steam Piping: Less than 1.0" diameter: 3" rigid glass fiber, 1.0-1.5" diameter piping: 4" rigid glass fiber, 2" and greater diameter piping: 4" rigid glass fiber .
 3. Low Pressure Steam Condensate: Less than 1.0" diameter: 3" rigid glass fiber, 1.0-1.5" diameter piping: 4" rigid glass fiber, 2" and greater diameter piping: 4" rigid glass fiber .
- B. Cooling Systems:
 1. Chilled Water: Fluid range: 40-60 deg F - less than 1.5" diameter: 0.5" rigid glass fiber, 2" and greater diameter piping: 1" rigid glass fiber.
 2. Condenser Water: Less than 1.5" diameter: 0.5" rigid glass fiber, 2" and greater diameter piping: 1" rigid glass fiber.
 3. Refrigerant Suction: Less than 1" diameter piping: 0.5" flexible elastomeric, 1" and greater diameter piping: 1" flexible elastomeric insulation.
 4. Refrigerant Hot Gas: Less than 1" diameter piping: 0.5" flexible elastomeric, 1" and greater diameter piping: 1" flexible elastomeric insulation.

END OF SECTION

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SECTION 230923 DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. System description.
- B. Operator interface.
- C. Controllers.
- D. Power supplies and line filtering.
- E. System software.
- F. Controller software.
- G. HVAC control programs.
- H. Chiller control programs.

1.02 RELATED REQUIREMENTS

- A. Section 23 09 13 - Instrumentation and Control Devices for HVAC.
- B. Section 23 09 93 - Sequence of Operations for HVAC Controls.
- C. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks; 2020, with Addendum (2024).
- B. CTA-709.1 - Control Network Protocol Specification; 2019.
- C. MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests; 2019h.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for each system component and software module.
- C. Shop Drawings:
 - 1. Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.
 - 2. List connected data points, including connected control unit and input device.
 - 3. Indicate system graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations. Provide demonstration digital media containing graphics.
 - 4. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
 - 5. Indicate description and sequence of operation of operating, user, and application software.
- D. Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.
- E. Designer's Qualification Statement.
- F. Manufacturer's Qualification Statement.
- G. Installer's Qualification Statement.

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- H. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
 - 1. Revise shop drawings to reflect actual installation and operating sequences.
 - 2. Include submittals data in final "Record Documents" form.
- I. Operation and Maintenance Data:
 - 1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
 - 2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.
 - 3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
- J. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Perform work in accordance with NFPA 70.
- B. Designer Qualifications: Perform design of system using manufacturer's software under direct supervision of a Application Engineer experienced in design of this type of work.
- C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum 10 years of documented experience.
- D. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.
- E. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for purpose specified and indicated.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a one year period after Substantial Completion.
- C. Provide five year manufacturer's warranty for field programmable micro-processor based units.

1.08 PROTECTION OF SOFTWARE RIGHTS

- A. Prior to delivery of software, the Owner and the party providing the software will enter into a software license agreement with provisions for the following:
 - 1. Limiting use of software to equipment provided under these specifications.
 - 2. Provide three year software update subscription service. For a period of three years after substantial completion, software updates, programming and commissioning of updates shall be a part of the base contract.
 - 3. Limiting copying.
 - 4. Preserving confidentiality.
 - 5. Prohibiting transfer to a third party.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Trane, Inc: www.trane.com
- B. Honeywell International, Inc: www.honeywell.com/#sle.
- C. Johnson Controls, Inc: www.johnsoncontrols.com/#sle.
- D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 SYSTEM DESCRIPTION

- A. Automatic temperature control field monitoring and control system using field programmable micro-processor based units with communications to Building Management System specified in Section 2.03.
- B. 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.

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- C. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.
- D. 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 09 13.
- E. 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.
- F. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

2.03 OPERATOR INTERFACE

- A. PC Based Work Station:
 - 1. Resides on high speed network with building controllers.
 - 2. Connected to server for full access to all system information.
- B. Workstation, controllers, and control backbone to communicate using BACnet protocol and addressing.
- C. BACnet protocol to comply with ASHRAE Std 135.
- D. LonTalk protocol to comply with CTA-709.1.
- E. Hardware:
 - 1. Laptop:
 - a. Laptop(s) to be provided by DDC controls manufacturer.
 - b. Quantity: Provide allowance for one computer(s).
 - c. Minimum RAM: _____.
 - d. Minimum Processing Speed: _____.
 - e. Minimum Hard Drive Memory: _____.
 - f. Drives: _____.
 - g. Ports: _____.
 - h. Display: _____.
 - i. Network Connection:
 - 1) Ethernet interface card.
 - 2) Minimum Speed: _____.

2.04 CONTROLLERS

- A. Building Controllers:
 - 1. General:
 - a. Manage global strategies by one or more, independent, standalone, microprocessor based controllers.
 - b. Provide sufficient memory to support controller's operating system, database, and programming requirements.
 - c. Share data between networked controllers.
 - d. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
 - e. Utilize real-time clock for scheduling.
 - f. Continuously check processor status and memory circuits for abnormal operation.
 - g. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
 - h. Communication with other network devices to be based on assigned protocol.
 - 2. Communication:
 - a. Controller to reside on a BACnet network using ISO 8802-3 (ETHERNET) Data Link/Physical layer protocol.
 - b. Perform routing when connected to a network of custom application and application specific controllers.
 - c. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
 - 3. Anticipated Environmental Ambient Conditions:
 - a. Outdoors and/or in Wet Ambient Conditions:
 - 1) Mount within waterproof enclosures.

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- 2) Rated for operation at 40 to 150 degrees F.
 - b. Conditioned Space:
 - 1) Mount within dustproof enclosures.
 - 2) Rated for operation at 32 to 120 degrees F.
 4. Provisions for Serviceability:
 - a. Diagnostic LEDs for power, communication, and processor.
 - b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
 5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
 6. Power and Noise Immunity:
 - a. Maintain operation at 90 to 110 percent of nominal voltage rating.
 - b. Perform orderly shutdown below 80 percent of nominal voltage.
 - c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.
- B. Custom Application Controller:
1. General:
 - a. Provide sufficient memory to support controller's operating system, database, and programming requirements.
 - b. Share data between networked, microprocessor based controllers.
 - c. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
 - d. Utilize real-time clock for scheduling.
 - e. Continuously check processor status and memory circuits for abnormal operation.
 - f. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
 - g. Communication with other network devices to be based on assigned protocol.
 2. Communication:
 - a. Controller to reside on a BACnet network using MS/TP Data Link/Physical layer protocol.
 - b. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
 3. Anticipated Environmental Ambient Conditions:
 - a. Outdoors and/or in Wet Ambient Conditions:
 - 1) Mount within waterproof enclosures.
 - 2) Rated for operation at 40 to 150 degrees F.
 - b. Conditioned Space:
 - 1) Mount within dustproof enclosures.
 - 2) Rated for operation at 32 to 120 degrees F.
 4. Provisions for Serviceability:
 - a. Diagnostic LED's for power, communication, and processor.
 - b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
 5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
 6. Power and Noise Immunity:
 - a. Maintain operation at 90 to 110 percent of nominal voltage rating.
 - b. Perform orderly shutdown below 80 percent of nominal voltage.
 - c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.
- C. Application Specific Controllers:
1. General:
 - a. Not fully user programmable, microprocessor based controllers dedicated to control specific equipment.
 - b. Customized for operation within the confines of equipment served.
 - c. Communication with other network devices to be based on assigned protocol.
 2. Communication:
 - a. Controller to reside on a BACnet network using MS/TP Data Link/Physical layer protocol.
 - b. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
 3. Anticipated Environmental Ambient Conditions:

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- a. Outdoors and/or in Wet Ambient Conditions:
 - 1) Mount within waterproof enclosures.
 - 2) Rated for operation at 40 to 150 degrees F.
- b. Conditioned Space:
 - 1) Mount within dustproof enclosures.
 - 2) Rated for operation at 32 to 120 degrees F.
4. Provisions for Serviceability:
 - a. Diagnostic LEDs for power, communication, and processor.
 - b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
6. Power and Noise Immunity:
 - a. Maintain operation at 90 to 110 percent of nominal voltage rating.
 - b. Perform orderly shutdown below 80 percent of nominal voltage.
 - c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3 feet.
- D. Input/Output Interface:
 1. Hardwired inputs and outputs tie into the DDC system through building, custom application, or application specific controllers.
 2. All Input/Output Points:
 - a. Protect controller from damage resulting from any point short-circuiting or grounding and from voltage up to 24 volts of any duration.
 - b. Provide universal type for building and custom application controllers where input or output is software designated as either binary or analog type with appropriate properties.
 3. Binary Inputs:
 - a. Allow monitoring of On/Off signals from remote devices.
 - b. Provide wetting current of 12 mA minimum, compatible with commonly available control devices and protected against the effects of contact bounce and noise.
 - c. Sense dry contact closure with power provided only by the controller.
 4. Pulse Accumulation Input Objects: Comply with all requirements of binary input objects and accept up to 10 pulses per second.
 5. Analog Inputs:
 - a. Allow for monitoring of low voltage 0 to 10 VDC, 4 to 20 mA current, or resistance signals (thermistor, RTD).
 - b. Compatible with and field configurable to commonly available sensing devices.
 6. Binary Outputs:
 - a. Used for On/Off operation or a pulsed low-voltage signal for pulse width modulation control.
 - b. Outputs provided with three position (On/Off/Auto) override switches.
 - c. Status lights for building and custom application controllers to be selectable for normally open or normally closed operation.
 7. Analog Outputs:
 - a. Monitoring signal provides a 0 to 10 VDC or a 4 to 20 mA output signal for end device control.
 - b. Provide status lights and two position (AUTO/MANUAL) switch for building and custom application controllers with manually adjustable potentiometer for manual override on building and custom application controllers.
 - c. Drift to not exceed 0.4 percent of range per year.
 8. Tri State Outputs:
 - a. Coordinate two binary outputs to control three point, floating type, electronic actuators without feedback.
 - b. Limit the use of three point, floating devices to the following zone and terminal unit control applications:
 - 1) Radiation.
 - c. Control algorithms run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.
 9. System Object Capacity:
 - a. System size to be expandable to twice the number of input output objects required by providing additional controllers, including associated devices and wiring.
 - b. Hardware additions or software revisions for the installed operator interfaces are not to be required for future, system expansions.

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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 LOCAL AREA NETWORK (LAN)

- A. Provide communication between control units over local area network (LAN).
- B. LAN Capacity: Not less than 60 stations or nodes.
- C. Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.
- D. LAN Data Speed: Minimum 19.2 Kb.
- E. Communication Techniques: Allow interface into network by multiple operation stations and by auto-answer/auto-dial modems. Support communication over telephone lines utilizing modems.
- F. Transmission Median: Fiber optic or single pair of solid 24 gauge twisted, shielded copper cable.
- G. Network Support: Time for global point to be received by any station, shall be less than 3 seconds. Provide automatic reconfiguration if any station is added or lost. If transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.

2.07 SYSTEM SOFTWARE

- A. Operating System:
 - 1. Concurrent, multi-tasking capability.
 - a. Common Software Applications Supported: Microsoft Excel.
 - b. Acceptable Operating Systems: _____.
 - 2. System Graphics:
 - a. Allow up to 10 graphic screens, simultaneously displayed for comparison and monitoring of system status.
 - b. Animation displayed by shifting image files based on object status.
 - c. Provide method for operator with password to perform the following:
 - 1) Move between, change size, and change location of graphic displays.
 - 2) Modify on-line.
 - 3) Add, delete, or change dynamic objects consisting of:
 - (a) Analog and binary values.
 - (b) Dynamic text.
 - (c) Static text.
 - (d) Animation files.
 - 3. Custom Graphics Generation Package:
 - a. Create, modify, and save graphic files and visio format graphics in PCX formats.
 - b. HTML graphics to support web browser compatible formats.
 - c. Capture or convert graphics from AutoCAD and Designer.

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4. Standard HVAC Graphics Library:
 - a. HVAC Equipment:
 - 1) Chillers.
 - 2) Boilers.
 - 3) Air Handlers.
 - 4) Terminal HVAC Units.
 - 5) Fan Coil Units.
 - 6) Unit Ventilators.
 - b. Ancillary Equipment:
 - 1) Fans.
 - 2) Pumps.
 - 3) Coils.
 - 4) Valves.
 - 5) Piping.
 - 6) Dampers.
 - 7) Ductwork.
- B. Workstation System Applications:
 1. Automatic System Database Save and Restore Functions:
 - a. Current database copy of each Building Controller is automatically stored on hard disk.
 - b. Automatic update occurs upon change in any system panel.
 - c. In the event of database loss in any system panel, the first workstation to detect the loss automatically restores the database for that panel unless disabled by the operator.
 2. Manual System Database Save and Restore Functions by Operator with Password Clearance:
 - a. Save database from any system panel.
 - b. Clear a panel database.
 - c. Initiate a download of a specified database to any system panel.
 3. Software provided allows system configuration and future changes or additions by operators under proper password protection.
 4. On-line Help:
 - a. Context-sensitive system assists operator in operation and editing.
 - b. Available for all applications.
 - c. Relevant screen data provided for particular screen display.
 - d. Additional help available via hypertext.
 5. Security:
 - a. Operator log-on requires user name and password to view, edit, add, or delete data.
 - b. System security selectable for each operator.
 - c. System supervisor sets passwords and security levels for all other operators.
 - d. Operator passwords to restrict functions accessible to viewing and/or changing system applications, editor, and object.
 - e. Automatic, operator log-off results from keyboard or mouse inactivity during user-adjustable, time period.
 - f. All system security data stored in encrypted format.
 6. System Diagnostics:
 - a. Operations Automatically Monitored:
 - 1) Workstations.
 - 2) Printers.
 - 3) Modems.
 - 4) Network connections.
 - 5) Building management panels.
 - 6) Controllers.
 - b. Device failure is annunciated to the operator.
 7. Alarm Processing:
 - a. All system objects are configurable to "alarm in" and "alarm out" of normal state.
 - b. Configurable Objects:
 - 1) Alarm limits.
 - 2) Alarm limit differentials.
 - 3) States.
 - 4) Reactions for each object.
 8. Alarm Messages:
 - a. Descriptor: English language.
 - b. Recognizable Features:

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- 1) Source.
 - 2) Location.
 - 3) Nature.
9. Configurable Alarm Reactions by Workstation and Time of Day:
- a. Logging.
 - b. Printing.
 - c. Starting programs.
 - d. Displaying messages.
 - e. Dialing out to remote locations.
 - f. Paging.
 - g. Providing audible annunciation.
 - h. Displaying specific system graphics.
10. Custom Trend Logs:
- a. Definable for any data object in the system including interval, start time, and stop time.
 - b. Trend Data:
 - 1) Sampled and stored on the building controller panel.
 - 2) Archivable on hard disk.
 - 3) Retrievable for use in reports, spreadsheets and standard database programs.
 - 4) Archival on LAN accessible storage media including hard disk, tape, Raid array drive, and virtual cloud environment.
 - 5) Protected and encrypted format to prevent manipulation, or editing of historical data and event logs.
11. Alarm and Event Log:
- a. View all system alarms and change of states from any system location.
 - b. Events listed chronologically.
 - c. Operator with proper security acknowledges and clears alarms.
 - d. Alarms not cleared by operator are archived to the workstation hard disk.
12. Object, Property Status and Control:
- a. Provide a method to view, edit if applicable, the status of any object and property in the system.
 - b. Status Available by the Following Methods:
 - 1) Menu.
 - 2) Graphics.
 - 3) Custom Programs.
13. Reports and Logs:
- a. Reporting Package:
 - 1) Allows operator to select, modify, or create reports.
 - 2) Definable as to data content, format, interval, and date.
 - 3) Archivable to hard disk.
 - b. Real-time logs available by type or status such as alarm, lockout, normal, etc.
 - c. Stored on hard disk and readily accessible by standard software applications, including spreadsheets and word processing.
 - d. Set to be printed on operator command or specific time(s).
14. Reports:
- a. Standard:
 - 1) Objects with current values.
 - 2) Current alarms not locked out.
 - 3) Disabled and overridden objects, points and SNVTs.
 - 4) Objects in manual or automatic alarm lockout.
 - 5) Objects in alarm lockout currently in alarm.
 - 6) Logs:
 - (a) Alarm History.
 - (b) System messages.
 - (c) System events.
 - (d) Trends.
 - b. Custom:
 - 1) Daily.
 - 2) Weekly.
 - 3) Monthly.
 - 4) Annual.
 - 5) Time and date stamped.
 - 6) Title.
 - 7) Facility name.

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- c. Tenant Override:
 - 1) Monthly report showing total, requested, after-hours HVAC and lighting services on a daily basis for each tenant.
 - 2) Annual report showing override usage on a monthly basis.
 - d. Electrical, Fuel, and Weather:
 - 1) Electrical Meter(s):
 - (a) Monthly showing daily electrical consumption and peak electrical demand with time and date stamp for each meter.
 - (b) Annual summary showing monthly electrical consumption and peak demand with time and date stamp for each meter.
 - 2) Fuel Meter(s):
 - (a) Monthly showing daily natural gas consumption for each meter.
 - (b) Annual summary showing monthly consumption for each meter.
 - 3) Weather:
 - (a) Monthly showing minimum, maximum, average outdoor air temperature and heating/cooling degree-days for the month.
- C. Workstation Applications Editors:
- 1. Provide editing software for each system application at PC workstation.
 - 2. Downloaded application is executed at controller panel.
 - 3. Full screen editor for each application allows operator to view and change:
 - a. Configuration.
 - b. Name.
 - c. Control parameters.
 - d. Set-points.
 - 4. Scheduling:
 - a. Monthly calendar indicates schedules, holidays, and exceptions.
 - b. Allows several related objects to be scheduled and copied to other objects or dates.
 - c. Start and stop times adjustable from master schedule.
 - 5. Custom Application Programming:
 - a. Create, modify, debug, edit, compile, and download custom application programming during operation and without disruption of all other system applications.
 - b. Programming Features:
 - 1) English oriented language, based on BASIC, FORTRAN, C, or PASCAL syntax allowing for free form programming.
 - 2) Alternative language graphically based using appropriate function blocks suitable for all required functions and amenable to customizing or compounding.
 - 3) Insert, add, modify, and delete custom programming code that incorporates word processing features such as cut/paste and find/replace.
 - 4) Allows the development of independently, executing, program modules designed to enable and disable other modules.
 - 5) Debugging/simulation capability that displays intermediate values and/or results including syntax/execution error messages.
 - 6) Support for conditional statements (IF/THEN/ELSE/ELSE-F) using compound Boolean (AND, OR, and NOT) and/or relations (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.
 - 7) Support for floating-point arithmetic utilizing plus, minus, divide, times, square root operators; including absolute value; minimum/maximum value from a list of values for mathematical functions.
 - 8) Language consisting of resettable, predefined, variables representing time of day, day of the week, month of the year, date; and elapsed time in seconds, minutes, hours, and days where the variable values can be used in IF/THEN comparisons, calculations, programming statement logic, etc.
 - 9) Language having predefined variables representing status and results of the system software enables, disables, and changes the set points of the controller software.

2.08 CONTROLLER SOFTWARE

- A. All applications reside and operate in the system controllers and editing of all applications occurs at the operator workstation.
- B. System Security:
 - 1. User access secured via user passwords and user names.

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2. Passwords restrict user to the objects, applications, and system functions as assigned by the system manager.
 3. User Log On/Log Off attempts are recorded.
 4. Automatic Log Off occurs following the last keystroke after a user defined delay time.
- C. Object or Object Group Scheduling:
1. Weekly Schedules Based on Separate, Daily Schedules:
 - a. Include start, stop, optimal stop, and night economizer.
 - b. 10 events maximum per schedule.
 - c. Start/stop times adjustable for each group object.
 2. Exception Schedules:
 - a. Based on any day of the year.
 - b. Defined up to one year in advance.
 - c. Automatically discarded and replaced with standard schedule for that day of the week upon execution.
 3. Holiday or Special Schedules:
 - a. Capability to define up to 99 schedules.
 - b. Repeated annually.
 - c. Length of each period is operator defined.
- D. Provide standard application for equipment coordination and grouping based on function and location to be used for scheduling and other applications.
- E. Alarms:
1. Binary object is set to alarm based on the operator specified state.
 2. Analog object to have high/low alarm limits.
 3. All alarming is capable of being automatically and manually disabled.
 4. Alarm Reporting:
 - a. Operator determines action to be taken for alarm event.
 - b. Alarms to be routed to appropriate workstation.
 - c. Reporting Options:
 - 1) Start programs.
 - 2) Logged.
 - 3) Custom messaging.
 - 4) Graphical displays.
- F. Demand Limiting:
1. Building power consumption monitored from signals generated by a current transformer, mounted at the building power meter.
 2. Demand limit controlled via load shedding or load restoration in a predetermined and predictive manner.
 3. Demand Reduction Methods:
 - a. Supply air temperature reset.
 - b. Space temperature set-point reset.
 - c. Equipment off/on prioritization.
 4. Relevant variables that influence demand limiting control are based on the power company methodology for computing demand charges.
 5. Operator On-Line Changes Allowed:
 - a. Addition and deletion of loads controlled.
 - b. Changes in demand intervals.
 - c. Changes in demand limit for meter(s).
 - d. Maximum equipment shutoff time.
 - e. Minimum equipment shutoff time.
 - f. Select rotational or sequential shedding and restoring.
 - g. Shed/restore priority.
 6. Information and Reports available Hourly, Daily, and Monthly:
 - a. Total electric consumption.
 - b. Peak demand.
 - c. Date and time of peak demand.
 - d. Daily peak demand.
- G. Maintenance Management: System monitors equipment status and generates maintenance messages based upon user-designated run-time limits.
- H. Sequencing: Application software based upon specified sequences of operation in Section 23 09 93.

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- I. PID Control Characteristics:
 - 1. Direct or reverse action.
 - 2. Anti-windup.
 - 3. Calculated, time-varying, analog value, positions an output or stages a series of outputs.
 - 4. User selectable controlled variable, set-point, and PED gains.
- J. Staggered Start Application:
 - 1. Prevents all controlled equipment from simultaneously restarting after power outage.
 - 2. Order of equipment startup is user selectable.
- K. Energy Calculations:
 - 1. Accumulated instantaneous power or flow rates are converted to energy use data.
 - 2. Algorithm calculates a rolling average and allows window of time to be user specified in minute intervals.
 - 3. Algorithm calculates a fixed window average with a digital input signal from a utility meter defining the start of the window period that in turn synchronizes the fixed-window average with that used by the power company.
- L. Anti-Short Cycling:
 - 1. All binary output objects protected from short-cycling.
 - 2. Allows minimum on-time and off-time to be selected.
- M. On-Off Control with Differential:
 - 1. Algorithm allows binary output to be cycled based on a controlled variable and set-point.
 - 2. Algorithm to be direct-acting or reverse-acting incorporating an adjustable differential.
- N. Run-Time Totalization:
 - 1. Totalize run-times for all binary input objects.
 - 2. Provides operator with capability to assign high run-time alarm.

2.09 HVAC CONTROL PROGRAMS

- A. General:
 - 1. Support Inch-pounds and SI (metric) units of measurement.
 - 2. Identify each HVAC Control system.
- B. Optimal Run Time:
 - 1. Control start-up and shutdown times of HVAC equipment for both heating and cooling.
 - 2. Base on occupancy schedules, outside air temperature, seasonal requirements, and interior room mass temperature.
 - 3. Start-up systems by using outside air temperature, room mass temperatures, and adaptive model prediction for how long building takes to warm up or cool down under different conditions.
 - 4. Use outside air temperature to determine early shut down with ventilation override.
 - 5. Operator commands:
 - a. Define term schedule.
 - b. Add/delete fan status point.
 - c. Add/delete outside air temperature point.
 - d. Add/delete mass temperature point.
 - e. Define heating/cooling parameters.
 - f. Define mass sensor heating/cooling parameters.
 - g. Lock/unlock program.
 - h. Request optimal run time control summary.
 - i. Request optimal run time mass temperature summary.
 - j. Request HVAC point summary.
 - k. Request HVAC saving profile summary.
 - 6. Control Summary:
 - a. HVAC Control system begin/end status.
 - b. Optimal run time lock/unlock control status.
 - c. Heating/cooling mode status.
 - d. Optimal run time schedule.
 - e. Start/Stop times.
 - f. Optimal run time system normal start times.
 - g. Occupancy and vacancy times.
 - h. Optimal run time system heating/cooling mode parameters.
 - 7. Mass temperature summary:

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- a. Mass temperature point type and ID.
- b. Calculated warm-up/cool-down time for each mass temperature.
- c. Break point temperature for cooling mode analysis.
8. HVAC point summary:
 - a. Control system identifier and status.
 - b. Point ID and status.
 - c. Outside air temperature point ID and status.
 - d. Calculated optimal start and stop times.
 - e. Period start.
- C. Supply Air Reset:
 1. Monitor heating and cooling loads in building spaces, terminal reheat systems, single zone unit discharge temperatures.
 2. Adjust discharge temperatures to most energy efficient levels satisfying measured load by:
 - a. Raising cooling temperatures to highest possible value.
 - b. Reducing heating temperatures to lowest possible level.
 3. Operator commands:
 - a. Add/delete fan status point.
 - b. Lock/unlock program.
 - c. Request HVAC point summary.
 - d. Add/Delete discharge controller point.
 - e. Define discharge controller parameters.
 - f. Add/delete air flow rate.
 - g. Define space load and load parameters.
 - h. Request space load summary.
 4. Control summary:
 - a. HVAC control system status (begin/end).
 - b. Supply air reset system status.
 - c. Optimal run time system status.
 - d. Heating and cooling loop.
 - e. High/low limits.
 - f. Deadband.
 - g. Response timer.
 - h. Reset times.
 5. Space load summary:
 - a. HVAC system status.
 - b. Optimal run time status.
 - c. Heating/cooling loop status.
 - d. Space load point ID.
 - e. Current space load point value.
 - f. Control heat/cool limited.
 - g. Calculated reset values.
 - h. Fan status point ID and status.
 - i. Control discharge temperature point ID and status.
 - j. Space load point ID and status.
 - k. Air flow rate point ID and status.
- D. Enthalpy Switchover:
 1. Calculate outside and return air enthalpy using measured temperature and relative humidity; determine energy expended and control outside and return air dampers.
 2. Operator commands:
 - a. Add/delete fan status point.
 - b. Add/delete outside air temperature point.
 - c. Add/delete discharge controller point.
 - d. Define discharge controller parameters.
 - e. Add/delete return air temperature point.
 - f. Add/delete outside air dew point/humidity point.
 - g. Add/delete return air dew point/humidity point.
 - h. Add/delete damper switch.
 - i. Add/delete minimum outside air.
 - j. Add/delete heating override switch.
 - k. Add/delete evaporative cooling switch.
 - l. Add/delete air flow rate.

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- m. Define enthalpy deadband.
- n. Lock/unlock program.
- o. Request control summary.
- p. Request HVAC point summary.
- 3. Control summary:
 - a. HVAC control system begin/end status.
 - b. Enthalpy switchover optimal system status.
 - c. Optimal return time system status.
 - d. Current outside air enthalpy.
 - e. Calculated mixed air enthalpy.
 - f. Calculated cooling coil enthalpy using outside air.
 - g. Calculated cooling coil enthalpy using mixed air.
 - h. Calculated enthalpy difference.
 - i. Enthalpy switchover deadband.
 - j. Status of damper mode switch.

2.10 CHILLER CONTROL PROGRAMS

- A. Control function of condenser water reset, chilled water reset, and chiller sequencing. Support inch-pounds and SI (metric) units of measurement.
- B. Chilled Water Reset: Automatically reset controlled chilled water temperature satisfying cooling coil requiring greatest cooling.

PART 3 EXECUTION

3.01 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 09 93.
- C. Provide conduit and electrical wiring in accordance with Section 26 05 83. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

3.02 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 one day period.
- C. Provide basic operator training for two persons on data display, alarm and status descriptors, requesting data, execution of commands and request of logs. Include a minimum of 24 hours dedicated instructor time. Provide training on site.

3.03 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate complete and operating system to Owner.

3.04 MAINTENANCE

- A. Provide service and maintenance of energy management and control systems for one year from Date of Substantial Completion.
- B. Provide two complete inspections per year, one in each season, to inspect, calibrate, and adjust controls as required, and submit written reports.

END OF SECTION

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SECTION 232113 HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hydronic system requirements.
- B. Heating water piping, buried.
- C. Heating water and glycol piping, buried.
- D. Heating water piping, above grade.
- E. Heating water and glycol piping, above grade.
- F. Chilled water piping, buried.
- G. Chilled water piping, above grade.
- H. Radiant heating piping system.
- I. Equipment drains and overflows.
- J. Pipe hangers and supports.
- K. Unions, flanges, mechanical couplings, and dielectric connections.
- L. Valves:
 - 1. Ball valves.
 - 2. Butterfly valves.
 - 3. Check valves.
 - 4. Pressure independent temperature control valves and balancing valves.
- M. Flow controls.

1.02 RELATED REQUIREMENTS

- A. Section 08 31 00 - Access Doors and Panels.
- B. Section 09 91 23 - Interior Painting.
- C. Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping.
- D. Section 23 05 53 - Identification for HVAC Piping and Equipment.
- E. Section 23 07 19 - HVAC Piping Insulation.
- F. Section 23 21 14 - Hydronic Specialties.
- G. Section 23 25 00 - HVAC Water Treatment: Pipe cleaning.

1.03 REFERENCE STANDARDS

- A. ANSI/FCI 70-2 - Control Valve Seat Leakage; 2021.
- B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.
- C. ASME B16.15 - Cast Copper Alloy Threaded Fittings: Classes 125 and 250; 2024.
- D. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
- E. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.
- F. ASME B16.34 - Valves — Flanged, Threaded, and Welding End; 2020.
- G. ASME B31.9 - Building Services Piping; 2020.
- H. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.
- I. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
- J. ASTM A106/A106M - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service; 2019a.

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- K. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- L. ASTM A183 - Standard Specification for Carbon Steel Track Bolts and Nuts; 2014 (Reapproved 2020).
- M. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.
- N. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).
- O. ASTM B32 - Standard Specification for Solder Metal; 2020.
- P. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.
- Q. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.
- R. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications; 2018.
- S. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 2024.
- T. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing; 2024.
- U. ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems; 2024.
- V. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications; 2007 (Reapproved 2019).
- W. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.
- X. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- Y. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.
- Z. AWWA C606 - Grooved and Shouldered Joints; 2022.
- AA. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the installation of 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.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Welders Certificate: Include welders certification of compliance with AWS D1.1/D1.1M.
- 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.
 - 4. Show grooved joint couplings, fittings, valves, and specialties on drawings and product submittals, specifically identified with the manufacturer's style or series designation.
- D. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.
- E. Project Record Documents: Record actual locations of valves.
- F. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.06 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 three years of experience.

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- C. Provide all grooved joint couplings, fittings, valves, specialties, and grooving tools from a single manufacturer.
- D. Date stamp all castings used for coupling housings, fittings, valve bodies, etc. for quality assurance and traceability.
- E. Coupling Manufacturer:
 - 1. Perform on-site training by factory-trained representative to the Contractor's field personnel in the proper use of grooving tools and installation of grooved joint products.
 - 2. Periodic job site visits by factory-trained representative to ensure best practices in grooved joint installation.
- F. Welder Qualifications: Certify in accordance with AWS D1.1/D1.1M.
 - 1. Provide certificate of compliance from authority having jurisdiction, indicating approval of welders.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.08 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. Use non-conducting dielectric connections whenever jointing dissimilar metals.
 - 3. Grooved mechanical joints may be used in any location.
 - a. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as approved by Architect.
 - b. Grooved mechanical connections and joints comply with AWWA C606.
 - 1) Ductile Iron: Comply with ASTM A536, Grade 65-45-12.
 - 2) Steel: Comply with ASTM A106/A106M, Grade B or ASTM A53/A53M.
 - 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.
 - 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.
 - 4. 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, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.
 - 1. Where grooved joints are used in piping, provide grooved valve/equipment connections if available; if not available, provide flanged ends and grooved flange adapters.
- 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 gate valves with cap; pipe to nearest floor drain.
 - 2. Isolate equipment using butterfly valves with lug end flanges or grooved mechanical couplings.
 - 3. For throttling, bypass, or manual flow control services, use globe, ball, or butterfly valves.
 - 4. For throttling and isolation service in chilled and condenser water systems, use only butterfly valves.

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5. In heating water or chilled water systems, butterfly valves may be used interchangeably with gate and globe valves.
6. For shut-off and to isolate parts of systems or vertical risers, use gate, ball, or butterfly valves.
7. For throttling service, use plug cocks. Use non-lubricated plug cocks only when shut-off or isolating valves are also provided.

E. Welding Materials and Procedures: Comply with ASME BPVC-IX.

2.02 HEATING WATER PIPING, BURIED

- A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, with AWWA C105/A21.5 polyethylene jacket, or double layer, half-lapped polyethylene tape.
- B. Copper Tube: ASTM B88 (((ASTM B88M))), Type K (A), annealed.

2.03 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 D1.1/D1.1M welded.
 2. Threaded Joints: ASME B16.3, malleable iron fittings.
 3. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.
- 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. Grooved Joints: AWWA C606 grooved tube, fittings of same material, and copper-tube-dimension mechanical couplings.
 3. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
 4. Mechanical Press Sealed Fittings: Double pressed type complying with ASME B16.22, utilizing EPDM, nontoxic synthetic rubber sealing elements.

2.04 CHILLED WATER PIPING, BURIED

- A. Steel Pipe: ASTM A53/A53M, Schedule 40, black with AWWA C105/A21.5 polyethylene jacket, or double layer, half-lapped polyethylene tape.
 1. Fittings: ASTM A234/A234M, wrought steel welding type with double layer, half-lapped polyethylene tape.
 2. Joints: Welded in accordance with AWS D1.1/D1.1M.
 3. Casing: Closed glass cell insulation.
- B. Copper Tube: ASTM B88 (((ASTM B88M))), Type K (A) annealed.

2.05 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 D1.1/D1.1M welded.
 2. Threaded Joints: ASME B16.3, malleable iron fittings.
 3. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.
- B. Copper Tube: ASTM B88 (((ASTM B88M))), Type K (A), hard drawn; using one of the following joint types:

2.06 RADIANT HEATING PIPING

- A. Cross-Linked Polyethylene (PEX) Pipe: ASTM F876 or ASTM F877.
- B. Composite Polyethylene Pipe: Aluminum tube laminated between two layers of high density polyethylene.
 1. Operating Pressure:
 - a. 125 psig at maximum 180 degrees F.
 2. Fittings: Brass flared compression.
 3. Joints: Fittings adapt to copper tubing or copper tube fittings, threaded pipe and fittings, and copper compression fittings.

2.07 EQUIPMENT DRAINS AND OVERFLOWS

- A. Steel Pipe: ASTM A53/A53M, Schedule 40 galvanized; using one of the following joint types:
 1. Threaded Joints: Galvanized cast iron, or ASME B16.3 malleable iron fittings.
 2. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.
- B. Copper Tube: ASTM B88 (((ASTM B88M))), Type K (A), drawn; using one of the following joint types:

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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. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

2.08 PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58.
1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
 2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inches: Malleable iron, 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.
 16. Hanger Rods: Mild 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.
- B. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads or with wedge-shaped grooves in header piping to permit support and hanging in accordance with ASME B31.9.
- C. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
1. Bases: High-density polypropylene.
 2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
 3. Steel Components: Stainless steel or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
 4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion-resistant material.
 5. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.

2.09 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

- 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.
- 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. Mechanical Couplings: Comply with ASTM F1476.
 3. Housing Material: Ductile iron complying with ASTM A536.
 4. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.

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5. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
 6. When pipe is field grooved, provide coupling manufacturer's grooving tools.
- D. Dielectric Connections:
1. Waterways:
 - a. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
 - b. Dry insulation barrier able to withstand 600-volt breakdown test.
 - c. Construct of galvanized steel with threaded end connections to match connecting piping.
 - d. Suitable for the required operating pressures and temperatures.
 2. Flanges:
 - a. Dielectric flanges with same pressure ratings as standard flanges.
 - b. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
 - c. Dry insulation barrier able to withstand 600-volt breakdown test.
 - d. Construct of galvanized steel with threaded end connections to match connecting piping.
 - e. Suitable for the required operating pressures and temperatures.

2.10 BALL VALVES

- A. Manufacturers:
1. Apollo Valves: www.apollovalves.com/#sle.
 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Up To and Including 2 Inches:
1. Brass two piece body, stainless steel ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder ends with union.
- C. Over 2 Inches:
1. Ductile iron body, chrome plated stainless steel ball, teflon or Virgin TFE seat and stuffing box seals, lever handle or gear operated, flanged ends, rated to 800 psi.

2.11 BUTTERFLY VALVES

- A. Manufacturers:
1. Apollo Valves: www.apollovalves.com/#sle.
 2. Grinnell Products; _____: www.grinnell.com/#sle.
 3. Victaulic Company: www.victaulic.com/#sle.
 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer, lug, or grooved ends, extended neck.
- C. Disc: Construct of aluminum bronze, chrome plated ductile iron, stainless steel, ductile iron with EPDM encapsulation, or Buna-N encapsulation.
- D. Stem: Stainless steel with stem offset from the centerline to provide full 360-degree circumferential setting.
- E. Operator: 10 position lever handle.

2.12 SWING CHECK VALVES

- A. Manufacturers:
1. Apollo Valves: www.apollovalves.com/#sle.
 2. Grinnell Products: www.grinnell.com/#sle.
 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Up To and Including 2 Inches:
1. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder ends.
- C. Over 2 Inches:
1. Iron body, bronze trim, stainless steel, bronze, or bronze faced rotating swing disc, renewable disc and seat, flanged or grooved ends.

2.13 SPRING LOADED CHECK VALVES

- A. Manufacturers:
1. Shurjoint Piping Products, Inc: www.shurjoint.com/#sle.
 2. Victaulic Company: www.victaulic.com/#sle.

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3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer, or threaded lug ends.

2.14 PRESSURE INDEPENDENT TEMPERATURE CONTROL VALVES AND BALANCING VALVES

- A. Manufacturers:
 1. Danfoss; AB-QM Valve: www.danfoss.com/#sle.
 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Control Valves: Factory-fabricated pressure independent with internal differential pressure regulator (DPRV), which automatically adjusts to normal changes in system pressure and provides 100 percent control valve authority at all positions of the valve.
 1. Maintain proportional and linear flow coil characteristics.
 2. PICV to accurately control the flow from 0 to 100 percent full rated flow with an operating pressure differential range of 3 to 60 psig.
 3. Provide ANSI/FCI 70-2 Class 4 shut-off on all sizes and field serviceable.
 4. Provide control valve to incorporate control, balancing, and flow limiting. Hydronic system pressure independent control valve bodies to comply with ASME B16.34 or ASME B16.15 pressure and temperature class ratings based on the design operating temperature and 150 percent of the system design operating pressure and have the following characteristics:
 - a. 2 NPS and Smaller: Class 150 bronze or brass body with union connections, stainless steel trim, stainless steel rising stem, stainless steel disc or ball, and screwed ends with backseating capacity repackable under pressure.
 - b. 2-1/2 NPS and Larger: Class 125 iron or ductile iron body, stainless steel trim, stainless steel rising stem, stainless steel disc or ball, flanged ends with backseating capacity repackable under pressure.
 - c. Pressure Control Seat: Brass construction with vulcanized EPDM.
 - d. Sizing: Line-size.
 - e. Fittings and Components: All fittings and components to meet ANSI standards and be compatible with readily available components. 8-inch valves and above to be provided with proper companion flanges.
 - f. Close-Off (Differential) Pressure Rating: Combination of actuator, DPRV action, and trim to provide a minimum close-off pressure rating of 150 percent of total system (pump) head. Provide actuator from the same manufacturer as the pressure independent control valve.
- C. Electronic Actuators: Direct-mounted, self-calibrating type designed for minimum 60,000 full-stroke cycles at rated force.
- D. Provide actuator with visible position indication. Fail positions on power failure to include in-place, open or closed as indicated in the controls specifications.
 1. Valves: Sized for maximum circuit flow rate and nominally, line-sized.
 2. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
 3. Fail-Safe Operation: Mechanical, spring-return mechanism or capacitance return.
 4. Power Requirements (Two-Position Spring Return): 24 VAC.
 5. Power Requirements (Modulating): Maximum 10 VA at 24 VAC or 8 watts at 24 VDC.
 6. Proportional Signal: 0 to 10 VDC or 2 to 10 VDC or 4 to 20 mA, and 2 to 10 VDC position feedback signal.
 7. Provide plenum-rated actuators for service above ceilings to possess UL listings and approvals.
 8. Temperature Rating: 40 to 104 degrees F.

2.15 FLOW CONTROLS

- A. Manufacturers:
 1. Griswold Controls: www.griswoldcontrols.com/#sle.
 2. Hays Fluid Controls: www.haysfluidcontrols.com/#sle.
 3. ITT Bell & Gossett: www.bellgossett.com/#sle.
 4. Taco, Inc: www.taco-hvac.com/#sle.
 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.
- C. Calibration: Control flow within 10 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, minimum pressure 2 psi.

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PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.
- C. Remove scale and dirt on inside and outside before assembly.
- D. Prepare piping connections to equipment using jointing system specified.
- E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- F. After completion, fill, clean, and treat systems. See Section 23 25 00 for additional requirements.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install heating water, glycol, chilled water, condenser water, and engine exhaust piping to ASME B31.9 requirements.
- C. Route piping in orderly manner, parallel to building structure, and maintain gradient.
- D. Install piping to conserve building space and to avoid interference with use of space.
- E. Group piping whenever practical at common elevations.
- F. Sleeve pipe passing through partitions, walls, and floors.
- G. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified.
- H. Slope piping and arrange to drain at low points.
- I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. See Section 23 05 16.
 - 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.
- J. 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.
- K. 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.
- L. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.
 - 2. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
 - 3. Place hangers within 12 inches of each horizontal elbow.
 - 4. Use hangers with 1-1/2 inches minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 5. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 - 6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 - 7. Provide copper plated hangers and supports for copper piping.
 - 8. Prime coat exposed steel hangers and supports. See Section 09 9123. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- M. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. See Section 23 07 19.

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- N. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 31 00 .
- O. Use eccentric reducers to maintain top of pipe level.
- P. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welds.
- Q. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting. See Section 09 91 23.
- R. Install valves with stems upright or horizontal, not inverted.

3.03 SCHEDULES

- A. Hanger Spacing for Copper Tubing.
 - 1. 1/2 Inch and 3/4 inch: Maximum span, 5 feet; minimum rod size, 1/4 inch.
 - 2. 1 Inch: Maximum span, 6 feet; minimum rod size, 1/4 inch.
 - 3. 1-1/2 Inches and 2 Inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 - 4. 2-1/2 Inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
 - 5. 3 Inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
 - 6. 4 Inches: Maximum span, 12 feet; minimum rod size, 1/2 inch.
- B. Hanger Spacing for Steel Piping.
 - 1. 1/2 Inch, 3/4 Inch, and 1 Inch: Maximum span, 7 feet; minimum rod size, 1/4 inch.
 - 2. 1-1/4 Inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 - 3. 1-1/2 Inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
 - 4. 2 Inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
 - 5. 2-1/2 Inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
 - 6. 3 Inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
 - 7. 4 Inches: Maximum span, 14 feet; minimum rod size, 1/2 inch.
 - 8. 6 Inches: Maximum span, 17 feet; minimum rod size, 1/2 inch.
- C. Hanger Spacing for Plastic Piping.
 - 1. 1/2 Inch: Maximum span, 42 inches; minimum rod size, 1/4 inch.
 - 2. 3/4 Inch: Maximum span, 45 inches; minimum rod size, 1/4 inch.
 - 3. 1 Inch: Maximum span, 51 inches; minimum rod size, 1/4 inch.
 - 4. 1-1/4 Inches: Maximum span, 57 inches; minimum rod size, 3/8 inch.
 - 5. 1-1/2 Inches: Maximum span, 63 inches; minimum rod size, 3/8 inch.
 - 6. 2 Inches: Maximum span, 69 inches; minimum rod size, 3/8 inch.
 - 7. 3 Inches: Maximum span, 7 feet; minimum rod size, 3/8 inch.
 - 8. 4 Inches: Maximum span, 8 feet; minimum rod size, 1/2 inch.
 - 9. 6 Inches: Maximum span, 10 feet; minimum rod size, 1/2 inch.
 - 10. 8 Inches: Maximum span, 11 feet; minimum rod size, 5/8 inch.

END OF SECTION

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SECTION 232114 HYDRONIC SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Compression tanks.
- B. Expansion tanks.
- C. Air vents.
- D. Air separators.
- E. Strainers.
- F. Suction diffusers.
- G. Pump connectors.
- H. Combination pump discharge valves.
- I. Pressure-temperature test plugs.
- J. Balancing valves.
- K. Automatic flow control valves.
- L. Flow meters.
- M. Relief valves.
- N. Pressure reducing valves.
- O. Glycol system.

1.02 RELATED REQUIREMENTS

- A. Section 22 10 06 - Plumbing Piping Specialties: Backflow preventers.
- B. Section 23 21 13 - Hydronic Piping.
- C. Section 23 25 00 - HVAC Water Treatment: Pipe cleaning.

1.03 REFERENCE STANDARDS

- A. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.
- B. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.
- C. ASME B16.11 - Forged Fittings, Socket-Welding and Threaded; 2021.
- D. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2023.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. 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.
- C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.
- D. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements for additional provisions.
 - 2. Extra Glycol Solution: One container, 1 gallon size.

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1.06 QUALITY ASSURANCE

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

1.07 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 COMPRESSION TANKS

- A. Manufacturers:
 - 1. Amtrol Inc: www.amtrol.com/#sle.
 - 2. ITT Bell & Gossett: www.bellgossett.com/#sle.
 - 3. Taco, Inc: www.taco-hvac.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Construction: Closed, welded steel, tested, and stamped in accordance with ASME BPVC-VIII-1; cleaned, prime coated, and supplied with steel support saddles; with tappings for installation of accessories.
 - 1. Pressure Rating: 100 psi.
- C. Gauge Glass Set: Brass compression stops, guard, and 3/4 inch red line glass, maximum 24 inches length, long enough to cover tank for 2 inches above bottom to 2 inches below top.
- D. Quick Connect Air Inlet:
 - 1. Compressed Air: 72 inches of 1/4 inch diameter braided reinforced air hose, air chuck, check valve, and shut-off valve on supply from control air compressor.
 - 2. Expansion Tank: Inlet tire check valve, manual air vent, tank drain, and pressure relief valve.
- E. Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure, double check backflow preventer, test cocks, strainer, vacuum breaker, and valved by-pass. Refer to Section 22 10 06.

2.02 EXPANSION TANKS

- A. Manufacturers:
 - 1. Amtrol Inc: www.amtrol.com/#sle.
 - 2. ITT Bell & Gossett: www.bellgossett.com/#sle.
 - 3. Taco, Inc: www.taco-hvac.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, adjustable flexible EPDM diaphragm or bladder seal factory precharged to 12 psi, and steel support stand.
- C. Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure double check backflow preventer, test cocks, strainer, vacuum breaker, and valved by-pass.

2.03 AIR VENTS

- A. Manufacturers:
 - 1. Armstrong International, Inc: www.armstronginternational.com/#sle.
 - 2. ITT Bell & Gossett: www.bellgossett.com/#sle.
 - 3. Taco, Inc: www.taco-hvac.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Manual Air Vent: Short vertical sections of 2-inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.
- C. Float Air Vent:
 - 1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
 - 2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.

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- D. Hygroscopic Air Vent:
 - 1. Brass with hygroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring-loaded ball check valve.
- E. Maximum Fluid Pressure: 150 psi.
- F. Maximum Fluid Temperature: 250 degrees F.

2.04 AIR SEPARATORS

- A. In-line Air Separators:
 - 1. Manufacturers:
 - a. Armstrong International, Inc: www.armstronginternational.com/#sle.
 - b. ITT Bell & Gossett: www.bellgossett.com/#sle.
 - c. Taco, Inc: www.taco-hvac.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Cast iron for sizes 1-1/2 inch and smaller, or steel for sizes 2 inch and larger; tested and stamped in accordance with ASME BPVC-VIII-1; for 125 psi operating pressure.
 - 3. Maximum Allowable Service Temperature: 450 degrees F.
- B. Centrifugal Air Separators/Strainers:
 - 1. Manufacturers:
 - a. Armstrong International, Inc: www.armstronginternational.com/#sle.
 - b. ITT Bell & Gossett: www.bellgossett.com/#sle.
 - c. Taco, Inc: www.taco-hvac.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Primed steel body, tested and stamped in accordance with ASME BPVC-VIII-1 with integral bronze strainer, tangential flanged inlet and outlet connections, and internal stainless steel air collector tube.
 - 3. Maximum Service Flow and Pressure: 16 gpm at 125 psi.

2.05 STRAINERS

- A. Manufacturers:
 - 1. Armstrong International, Inc: www.armstronginternational.com/#sle.
 - 2. Flexicraft Industries: www.flexicraft.com/#sle.
 - 3. Grinnell Products: www.grinnell.com/#sle.
 - 4. The Metraflex Company; LPD Y Strainer: www.metraflex.com/#sle.
 - 5. Substitutions: See Section 01 60 00 - 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 1/16 inch or 3/64 inch stainless steel perforated screen.
 - 2. Body Material by Fluid Service:
- D. Size 5 inch and Larger:
 - 1. Provide flanged or grooved iron body for 175 psi working pressure, basket pattern with 1/8 inch stainless steel perforated screen.
 - 2. Liquid Fluid Service: Up to 285 psi at 100 degrees F.

2.06 SUCTION DIFFUSERS

- A. Manufacturers:
 - 1. Anvil International: www.anvilintl.com/#sle.
 - 2. Grinnell Products: www.grinnell.com/#sle.
 - 3. Shurjoint Piping Products, Inc: www.shurjoint.com/#sle.
 - 4. Victaulic Company of America: www.victaulic.com/#sle.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Accessories: Adjustable foot support, blowdown tapping in bottom, gauge tapping in side.

2.07 PUMP CONNECTORS

- A. Manufacturers:
 - 1. Anvil International; AnviFlex: www.anvilintl.com/#sle.

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2. Ferguson Enterprises Inc: www.fnw.com/#sle.
 3. The Metraflex Company; Vane Flex: www.metraflex.com/#sle.
 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Flexible Connectors: Flanged, braided type with wetted components of stainless steel, sized to match piping.
1. Maximum Operating Service: 150 psi at 120 degrees F.
 2. Accommodate the Following:
 - a. Axial Deflection in Compression and Expansion: .
 - b. Lateral Movement: .
 - c. Angular Rotation: 15 degrees.
 - d. Force developed by 1.5 times specified maximum allowable operating pressure.
 3. End Connections: Same as specified for pipe jointing.
 4. Provide pump connector with integral vanes to reduce turbulent flow.
 5. Provide necessary accessories including, but not limited to, swivel joints.

2.08 COMBINATION PUMP DISCHARGE VALVES

- A. Manufacturers:
1. Anvil International: www.anvilintl.com/#sle.
 2. Crane Co.: www.craneco.com/#sle.
 3. Taco, Inc: www.taco-hvac.com/#sle.
 4. Victaulic Company of America: www.victaulic.com/#sle.
 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Quarter-Turn Plug Type: Flanged cast-iron body with bolt-on bonnet, position indicator, stainless steel stem, backflow preventer, memory stop, metering connectors, bubble-tight shutoff, and wrench-adjustable plug flow regulator.

2.09 PRESSURE-TEMPERATURE TEST PLUGS

- A. Manufacturers:
1. Ferguson Enterprises Inc: www.fnw.com/#sle.
 2. Peterson Equipment Company Inc: www.petesplug.com/#sle.
 3. Sisco Manufacturing Company Inc: www.siscomfg.com/#sle.
 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and Neoprene rated for minimum 200 degrees F.
- C. Application: Use extended length plugs to clear insulated piping.

2.10 BALANCING VALVES

- A. Manufacturers:
1. Armstrong International, Inc: www.armstronginternational.com/#sle.
 2. Ferguson Enterprises Inc: www.fnw.com/#sle.
 3. Hays Fluid Controls: www.haysfluidcontrols.com/#sle.
 4. Oventrop Corporation; Hydrocontrol F: www.ventrop.com/#sle.
 5. Taco, Inc: www.taco-hvac.com/#sle.
 6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Size 2 inch and Smaller:
1. Provide ball or globe style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and NPT threaded or soldered connections.
 2. Metal construction materials consist of bronze or brass.
 3. Non-metal construction materials consist of Teflon, EPDM, or engineered resin.
- C. Size 2-1/2 inch and Larger:
1. Provide ball, globe, or butterfly style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and flanged, grooved, or weld end connections.
- D. Valve body construction materials consist of cast iron, carbon steel, or ductile iron.
1. Internal components construction materials consist of brass, aluminum bronze, bronze, Teflon, EPDM, NORYL, or engineered resin.

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2.11 AUTOMATIC FLOW CONTROL VALVES

- A. Manufacturers:
 - 1. Armstrong International: www.armstronginternational.com/#sle.
 - 2. Hays Fluid Controls; Mesurflo Balancing Valve: www.haysfluidcontrols.com/#sle.
 - 3. Taco Inc: www.taco-hvac.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Construction:
 - 1. Brass, bronze, or iron body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet with blowdown/backflush drain.
 - 2. Built-in lug-type outlet butterfly valve with 2-position handle.
- C. Calibration: Control flow within 10 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, minimum pressure 2 psi.
- D. Control Mechanism: Provide stainless steel or nickel-plated, brass piston or regulator cup, operating against stainless steel helical or wave formed spring or elastomeric diaphragm and polyphenylsulfone orifice plate.

2.12 FLOW METERS

- A. Manufacturers:
 - 1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
 - 2. EMCO Flow Systems: www.emcoflow.com/#sle.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Orifice principle by-pass circuit with direct reading gauge, soldered or flanged piping connections for 125 psi working pressure, with shut off valves, and drain and vent connections.
- C. Direct reading with insert pitot tube, threaded coupling, for 150 psi working pressure, maximum 240 degrees F, 5 percent accuracy.
- D. Cast iron, wafer type, orifice insert flow meter for 250 psi working pressure, with read-out valves equipped with integral check valves with gasketed caps.

2.13 RELIEF VALVES

- A. Manufacturers:
 - 1. Apollo Valves: www.apollovalves.com/#sle.
 - 2. Armstrong International, Inc: www.armstronginternational.com/#sle.
 - 3. ITT Bell & Gossett: www.bellgossett.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.14 PRESSURE REDUCING VALVES

- A. Manufacturers:
 - 1. Apollo Valves: www.apollovalves.com/#sle.
 - 2. Armstrong International, Inc: www.armstronginternational.com/#sle.
 - 3. ITT Bell & Gossett: www.bellgossett.com/#sle.
 - 4. Taco, Inc: www.taco-hvac.com/#sle.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Operation: Automatically feeds make-up water to the hydronic system whenever pressure in the system drops below the pressure setting of the valve. Refer to Section 23 21 13.
- C. Materials of Construction:
 - 1. Valve Body: Constructed of bronze, cast iron, brass, or iron.
 - 2. Internal Components: Construct of stainless steel or brass and engineered plastics or composition material.
- D. Connections:
 - 1. NPT threaded: 0.50 inch or 0.75 inch.
 - 2. Soldered: 0.50 inch.
- E. Provide integral check valve and strainer.
- F. Maximum Inlet Pressure: 400 psi.

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- G. Maximum Fluid Temperature: 180 degrees F.
- H. Adjustable Pressure Range: From 10 to 45 psi, set to 25 psi.

2.15 PRESSURE INDEPENDENT VALVES

- A. Manufacturers:
 - 1. Griswold Controls LLC; PIC-V: www.griswoldcontrols.com/#sle.
 - 2. Oventrop Corporation; Cocon QTZ: www.ventrop.com/#sle.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Size 2 inch and Smaller:
 - 1. Provide ball or globe style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and NPT threaded or soldered connections.
 - 2. Metal construction materials consist of bronze or brass.
 - 3. Non-metal construction materials consist of Teflon, EPDM, or engineered resin.
- C. Size 2-1/2 inch and Larger:
 - 1. Provide ball, globe, or butterfly style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and flanged, grooved, or weld end connections.
 - 2. Valve body construction materials consist of cast iron, carbon steel, or ductile iron.
 - 3. Internal components construction materials consist of brass, aluminum bronze, bronze, Teflon, EPDM, NORYL, or engineered resin.

2.16 AUTOMATIC FLOW LIMITING VALVES

- A. Manufacturers:
 - 1. Griswold Controls LLC; Isolator R Valve: www.griswoldcontrols.com/#sle.
 - 2. Hays Fluid Controls: www.haysfluidcontrols.com/#sle.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Size 1/2 inch to 14 inch:
 - 1. Provide ball or globe style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and NPT threaded or soldered connections.
 - 2. Metal construction materials consist of bronze or brass.
 - 3. Non-metal construction materials consist of Teflon, EPDM, or engineered resin.
- C. Size 2-1/2 inch to 24 inch:
 - 1. Comply with ASME B16.5.
 - 2. Class: 150.
 - 3. Provide ball, globe, butterfly, or wafer style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and flanged, grooved, or weld end connections.
 - 4. Valve body construction materials consist of cast iron, carbon steel, ductile iron, or gray iron.
 - 5. Internal components construction materials consist of brass, aluminum bronze, bronze, Teflon, EPDM, NORYL, or engineered resin.

2.17 GLYCOL SYSTEM

- A. Pump System:
 - 1. Storage: 15 gal polypropylene tank with bolt-removable hinged solid cover and enamel coated carbon steel tank-stand.
 - 2. Pump:
 - a. Thermally protected 1/4 hp motor at 115 to 120 VAC, single phase rated for indoor service.
 - b. Maximum Service Operation: 100 psi at 85 degrees F.
 - 3. Mechanical Accessories: System isolation valves, strainer, and pressure gauges.
 - 4. Control Panel:
 - a. Fused single-point system connection rated at 115 to 120 VAC, single phase.
 - b. Interface: Hand switches with indicating lights for ON, FAULT, and LOW LEVEL.
 - c. Pressure Switch: Panel-mounted and prewired for 10 psi cut-in and 40 psi cut-out, adjustable.
 - d. Low Level Cut-Off Switch: Prewired to shut-down unit upon activation. Tank-side mounted.
 - 5. Pressure Relief Valve: System-mounted brass valve tubed from pump discharge side into tank with adjustable setpoint between 20 psi and 150 psi.
- B. Glycol Solution:
 - 1. Water-based solution mix containing 30 percent ethylene glycol by volume required for cooling or heating system operating temperature range.

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2. Cooling or heating System Operating Temperature Range: Between freezing and boiling points of 3 and 220 degees F at 14.7 psia.
- C. Air Pressure Reducing Station: Pressure reducing valve with shut-off valves, strainer, check valve, and needle valve bypass.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install specialties in accordance with manufacturer's instructions.
- B. Where large air quantities can accumulate, provide enlarged air collection standpipes.
- C. Provide manual air vents at system high points and as indicated.
- D. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.
- E. Provide air separator on suction side of system circulation pump and connect to expansion tank.
- F. Provide valved drain and hose connection on strainer blowdown connection.
- G. Provide pump suction fitting on suction side of base-mounted centrifugal pumps where indicated. Remove temporary strainers after cleaning systems.
- H. Provide combination pump discharge valve on discharge side of base mounted centrifugal pumps where indicated.
- I. Support pump fittings with floor-mounted pipe and flange supports.
- J. Provide radiator valves on water inlet to terminal heating units such as radiation, unit heaters, and fan coil units.
- K. Provide radiator balancing valves on water outlet from terminal heating units such as radiation, unit heaters, and fan coil units.
- L. Provide relief valves on pressure tanks, low-pressure side of reducing valves, heat exchangers, and expansion tanks.
- M. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.
- N. Pipe relief valve outlet to nearest floor drain.
- O. Where one line vents several relief valves, make cross-sectional area equal to sum of individual vent areas.
- P. Clean and flush glycol system before adding glycol solution, see Section 23 25 00.
- Q. Feed glycol solution to system through make-up line with pressure regulator, venting system high points.
- R. Feed glycol solution to system through make-up line with pressure regulator, venting system high points. Set to fill at 12 psi.
- S. Feed glycol solution to system through make-up line with pressure regulator, venting system high points. Pressure system cold at 5 psi.
- T. Perform tests determining strength of glycol and water solution and submit written test results.

3.02 MAINTENANCE

- A. See Section 01 70 00 - Execution Requirements for additional requirements relating to maintenance service.
- B. Provide service and maintenance of glycol system for one year from date of Substantial Completion at no extra charge to Owner.
- C. Perform monthly visit to make glycol fluid concentration analysis on site with refractive index measurement instrument. Report findings in detail in writing, including analysis and amounts of glycol or water added.
- D. Explain corrective actions to Owner's maintenance personnel in person.

END OF SECTION

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SECTION 232500 HVAC WATER TREATMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Materials.
 - 1. System cleaner.
 - 2. Closed system treatment (water).
- B. By-pass (pot) feeder.
- C. Solution metering pump.
- D. Solution tanks.
- E. Side-stream filtration equipment.

1.02 RELATED REQUIREMENTS

- A. Section 01 60 00 - Product Requirements: Owner furnished treatment equipment.
- B. Section 23 09 13 - Instrumentation and Control Devices for HVAC.
- C. Section 23 21 13 - Hydronic Piping.
- D. Section 23 21 14 - Hydronic Specialties.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.
- C. Shop Drawings: Indicate system schematic, equipment locations, and controls schematics, electrical characteristics and connection requirements.
- D. Manufacturer's Installation Instructions: Indicate placement of equipment in systems, piping configuration, and connection requirements.
- E. 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.
- F. Certificate: Submit certificate of compliance from Authority Having Jurisdiction indicating approval of chemicals and their proposed disposal.
- G. Project Record Documents: Record actual locations of equipment and piping, including sampling points and location of chemical injectors.
- H. 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.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - 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. Company shall have local representatives with water analysis laboratories and full time service personnel.
- B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experience and approved by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. AmSolv-Amrep, Inc; _____: www.amsolv.com/#sle.
- B. GE Water & Process Technologies; _____: www.gewater.com/#sle.

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- C. Nalco, an Ecolab Company; _____: www.nalco.com/#sle.
- D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 REGULATORY REQUIREMENTS

- A. Comply with applicable codes for addition of non-potable chemicals to building mechanical systems and to public sewage systems.
- B. Perform work in accordance with local health department regulations.

2.03 MATERIALS

- A. System Cleaner:
 - 1. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodiumtripoly phosphate and sodium molybdate.
 - 2. Biocide chlorine release agents such as sodium hypochlorite or calcium hypochlorite or microbiocides such as quarternary ammonia compounds, tributyltin oxide, methylene bis (thiocyanate).
- 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 tolyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.

2.04 BY-PASS (POT) FEEDER

- A. 2 quart quick opening cap for working pressure of 175 psi.

2.05 SOLUTION METERING PUMP

- A. Positive displacement, diaphragm pump with adjustable flow rate, thermoplastic construction, continuous-duty fully enclosed electric motor and drive, and built-in relief valve.
- B. Electrical Characteristics:
 - 1. Cord and Plug: Provide unit with 6 foot cord and plug for connection to electric wiring system including grounding connector.

2.06 SOLUTION TANKS

- A. 30 gallon capacity, polyethylene, self-supporting, 1 gallon graduated markings; molded fiberglass cover with recess for mounting pump, agitator, and liquid level switch.

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.

3.02 CLEANING SEQUENCE

- A. Concentration:
 - 1. One pound per 100 gallons of water for hot systems and one pound per 50 gallons of water for cold systems.
- B. Hot Water Heating Systems:
 - 1. Apply heat while circulating, slowly raising temperature to 160 degrees F and maintain for 12 hours minimum.
 - 2. Remove heat and circulate to 100 degrees F or less; drain systems as quickly as possible and refill with clean water.
 - 3. Circulate for 6 hours at design temperatures, then drain.
 - 4. Refill with clean water and repeat until system cleaner is removed.
- C. Chilled Water Systems:
 - 1. Circulate for 48 hours, then drain systems as quickly as possible.
 - 2. Refill with clean water, circulate for 24 hours, then drain.

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3. Refill with clean water and repeat until system cleaner is removed.
- D. Use neutralizer agents on recommendation of system cleaner supplier and approval of Architect.
- E. Flush open systems and glycol filled closed systems with clean water for one hour minimum. Drain completely and refill.
- F. Remove, clean, and replace strainer screens.
- G. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

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 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.

3.06 MAINTENANCE

- A. Perform maintenance work using competent and qualified personnel under the supervision of the equipment manufacturer or original installer.
- B. Provide service and maintenance of treatment systems for one year from Date of Substantial Completion.
- C. Provide semi-annual 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.
- D. Provide laboratory and technical assistance services during this maintenance period.
- E. 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

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SECTION 233100 HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal ductwork.
- B. Nonmetal ductwork.
- C. Casings and plenums.
- D. Buried ductwork.
- E. Kitchen hood ductwork.
- F. Duct cleaning.

1.02 RELATED REQUIREMENTS

- A. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.
- B. Section 23 07 13 - Duct Insulation: External insulation and duct liner.
- C. Section 23 33 00 - Air Duct Accessories.
- D. Section 23 36 00 - Air Terminal Units.
- E. Section 23 37 00 - Air Outlets and Inlets.

1.03 REFERENCE STANDARDS

- A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; Most Recent Edition Cited by Referring Code or Reference Standard.
- B. 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; 2023.
- C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
- D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.
- E. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; 2012.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for duct materials, duct liner, and duct connections.
- C. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for half inch pressure class and higher systems.
- D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK).
- E. Manufacturer's Installation Instructions: Indicate special procedures for glass fiber ducts.
- F. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.05 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.
- B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experience.

1.06 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.

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Renovation

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PART 2 PRODUCTS

2.01 DUCT ASSEMBLIES

- A. Regulatory Requirements: Construct ductwork to comply with NFPA 90A standards.
- B. Ducts: Galvanized steel, unless otherwise indicated.
- C. Low Pressure Supply (Heating Systems): 1/2 inch w.g. pressure class, galvanized steel.
- D. Low Pressure Supply (System with Cooling Coils): 1/2 inch wg pressure class, galvanized steel.
- E. Buried Supply or Return: 1/2 inch w.g. pressure class fiber glass reinforced plastic HDPE.
- F. Medium and High Pressure Supply: 1/2 inch wg pressure class, galvanized steel.
- G. Return and Relief: 1/2 inch wg pressure class, galvanized steel.
- H. General Exhaust: 1/2 inch wg pressure class, galvanized steel.
- I. Kitchen Cooking Hood Exhaust: 1/2 inch w.g. pressure class, un-galvanized steel.
 - 1. Construct of 16 gauge, 0.0598 inch sheet steel using continuous external welded joints in rectangular sections.
- J. Dishwasher Exhaust: 1/2 inch w.g. pressure class, stainless steel.
 - 1. Construct of 18 gauge, 0.0500 inch stainless steel using continuous external welded joints in rectangular sections.
- K. Grease Exhaust: 1/2 inch w.g. pressure class, un-galvanized steel.
 - 1. Construct of 16 gauge un-galvanized steel.
 - 2. Construction:
 - a. Liquidtight with continuous external weld for all seams and joints.
 - b. Where ducts are not self draining back to equipment, provide low point drain pocket with copper drain pipe to sanitary sewer.
 - 3. Access Doors:
 - a. Provide for duct cleaning inside horizontal duct at drain pockets, every 10 feet and at each change of direction.
 - b. Use same material and thickness as duct with gaskets and sealants rated 1500 degrees F for grease tight construction.
- L. Fume Hood Exhaust: 1/2 inch wg pressure class, galvanized steel.
- M. Outside Air Intake: 1/2 inch wg pressure class, galvanized steel.
- N. Combustion Air: 1/2 inch wg pressure class, galvanized steel.
- O. Transfer Air and Sound Boots: 1/2 inch wg pressure class, fibrous glass.

2.02 DUCTWORK FABRICATION

- A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.
- B. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- C. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

2.03 MANUFACTURED DUCTWORK AND FITTINGS

- A. Mount floor mounted casings on 4 inch high concrete curbs. At floor, rivet panels on 8 inch centers to angles. Where floors are acoustically insulated, provide liner of galvanized 18 gauge, 0.0478 inch expanded metal mesh supported at 12 inch centers, turned up 12 inches at sides with sheet metal shields.

END OF SECTION

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SECTION 233300 AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air turning devices/extractors.
- B. Backdraft dampers - metal.
- C. Backdraft dampers - fabric.
- D. Combination fire and smoke dampers.
- E. Duct access doors.
- F. Fire dampers.
- G. Flexible duct connectors.
- H. Smoke dampers.
- I. Volume control dampers.

1.02 RELATED REQUIREMENTS

- A. Section 23 31 00 - HVAC Ducts and Casings.
- B. Section 23 36 00 - Air Terminal Units: Pressure regulating damper assemblies.

1.03 REFERENCE STANDARDS

- A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
- B. NFPA 92 - Standard for Smoke Control Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- 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. UL 33 - Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.
- F. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.
- G. UL 555C - Standard for Safety Ceiling Dampers; Current Edition, Including All Revisions.
- H. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.
- C. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers, duct access doors, fire dampers, and smoke dampers.
- D. Manufacturer's Installation Instructions: Provide instructions for fire dampers and combination fire and smoke dampers.
- E. Project Record Drawings: Record actual locations of access doors.

1.05 QUALITY ASSURANCE

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

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect dampers from damage to operating linkages and blades.

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PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

- A. Multi-blade device with blades aligned in short dimension; steel or aluminum construction; with individually adjustable blades, mounting straps.

2.02 BACKDRAFT DAMPERS - METAL

- A. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, 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.

2.03 BACKDRAFT DAMPERS - FABRIC

2.04 COMBINATION FIRE AND SMOKE DAMPERS

- A. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.
- B. Provide factory sleeve and collar for each damper.
- C. Multiple Blade Dampers: Fabricate with 16 gauge, 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, and lock, and 1/2 inch actuator shaft.
- D. Operators: UL listed and labelled spring return electric type suitable for 120 volts, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on exterior of duct and link to damper operating shaft.
- E. Normally Open Smoke Responsive Fire Dampers: Curtain type, closing upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure, stainless steel springs with locking devices to ensure positive closure for units mounted horizontally.
- F. Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled.

2.05 DUCT ACCESS DOORS

- A. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.
 - 1. Less Than 12 inches Square: Secure with sash locks.
 - 2. Up to 18 inches Square: Provide two hinges and two sash locks.
 - 3. Up to 24 by 48 inches: Three hinges and two compression latches with outside and inside handles.
 - 4. Larger Sizes: Provide an additional hinge.
 - 5. High Temperature Duct Access Doors:
 - a. Comply with NFPA 96.
- B. Access doors with sheet metal screw fasteners are not acceptable.

2.06 FIRE DAMPERS

- A. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.
- B. Ceiling (Radiation) Dampers: Galvanized steel, 22 gauge, 0.0299 inch frame and 16 gauge, 0.0598 inch flap, two layers 0.125 inch ceramic fiber on top side and one layer on bottom side for round flaps, with locking clip.
 - 1. Rated for three hour service in compliance with UL 555C.
- C. Horizontal Dampers: Galvanized steel, 22 gauge, 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. Configure with blades out of air stream except for 1.0 inch pressure class ducts up to 12 inches in height.
- E. 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.

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- F. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

2.07 FLEXIBLE DUCT CONNECTORS

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.
- B. Flexible Duct Connections: Fabric crimped into metal edging strip.
 - 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
 - a. Net Fabric Width: Approximately 2 inches wide.
 - 2. Metal: 3 inches wide, 24 gauge, 0.0239 inch thick galvanized steel.
- C. Leaded Vinyl Sheet: Minimum 0.55 inch thick, 0.87 lbs per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.
- D. Maximum Installed Length: 14 inch.

2.08 SMOKE DAMPERS

- A. Fabricate in accordance with NFPA 90A and UL 555S, and as indicated.
- B. Dampers: UL Class 1 airfoil blade type smoke damper, normally open automatically operated by electric actuator.
- C. Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled.

2.09 VOLUME CONTROL DAMPERS

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.
- B. Splitter Dampers:
 - 1. Material: Same gauge as duct to 24 inches size in either direction, and two gauges heavier for sizes over 24 inches.
 - 2. Blade: Fabricate of double thickness sheet metal to streamline shape, secured with continuous hinge or rod.
 - 3. Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw.
- C. Single Blade Dampers:
 - 1. Fabricate for duct sizes up to 6 by 30 inch.
 - 2. Blade: 24 gauge, 0.0239 inch, minimum.
- D. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
 - 1. Blade: 18 gauge, 0.0478 inch, minimum.
- E. 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.
- F. 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.

PART 3 EXECUTION

3.01 PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 31 00 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, and elsewhere as indicated. Provide for

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cleaning kitchen exhaust ducts in accordance with NFPA 96 Provide minimum 8 by 8 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 fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by Authorities Having Jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
- E. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.
- F. Demonstrate re-setting of fire dampers to Owner's representative.
- G. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.
- H. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.
- I. For fans developing static pressures of 5.0 inches and over, cover flexible connections with leaded vinyl sheet, held in place with metal straps.
- J. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
- K. Use splitter dampers only where indicated.
- L. Provide balancing dampers on high velocity systems where indicated. Refer to Section 23 36 00 - Air Terminal Units.
- M. 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.

END OF SECTION

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SECTION 233416 CENTRIFUGAL HVAC FANS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Backward inclined centrifugal fans.
- B. Forward curved centrifugal fans.
- C. Airfoil wheel centrifugal fans.
- D. Bearings and drives.
- E. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 23 05 13 - Common Motor Requirements for HVAC Equipment.
- B. Section 23 05 48 - Vibration and Seismic Controls for HVAC.
- C. Section 23 07 13 - Duct Insulation.
- D. Section 23 33 00 - Air Duct Accessories: Backdraft dampers.

1.03 REFERENCE STANDARDS

- A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015 (Reaffirmed 2020).
- B. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.
- C. AMCA 99 - Standards Handbook; 2016.
- D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016, with Errata (2018).
- 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. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on centrifugal fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.
- C. Shop Drawings: Indicate assembly of centrifugal fans and accessories including fan curves with specified operating point clearly plotted, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.
- D. Manufacturer's Instructions: Include complete installation instructions.
- E. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Fan Belts: One set for each individual fan.

1.05 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.

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1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect motors, shafts, and bearings from weather and construction dust.

1.07 FIELD CONDITIONS

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ACME Engineering and Manufacturing Corporation; _____: www.acmefan.com/#sle.
- B. Greenheck Fan Corporation; greenheck.com
- C. Loren Cook Company; _____: www.lorencook.com/#sle.
- D. PennBarry, Division of Air System Components; _____: www.pennbarry.com/#sle.
- E. Twin City Fan & Blower; _____: www.tcf.com/#sle.
- F. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

- A. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.
- B. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.
- C. Fabrication: Comply with AMCA 99.
- D. Performance Base: 5000 foot elevation conditions.
- E. Temperature Limit: Maximum 300 degrees F.
- F. Static and Dynamic Balance: Eliminate vibration or noise transmission to occupied areas.

2.03 WHEEL AND INLET

- A. Backward Inclined: Steel or aluminum construction with smooth curved inlet flange, heavy back plate, backwardly curved blades welded or riveted to flange and back plate; cast iron or cast steel hub riveted to back plate and keyed to shaft with set screws.
- B. Forward Curved: Galvanized steel construction with inlet flange, back plate, shallow blades with inlet and tip curved forward in direction of airflow, mechanically secured to flange and back plate; steel hub swaged to back plate and keyed to shaft with set screw.
- C. Airfoil Wheel: Steel construction with smooth curved inlet flange, heavy back plate die formed hollow airfoil shaped blades continuously welded at tip flange, and back plate; cast iron or cast steel hub riveted to back plate and keyed to shaft with set screws.

2.04 HOUSING

- A. Heavy gauge steel, spot welded for AMCA 99 Class I and II fans, and continuously welded for Class III, adequately braced, designed to minimize turbulence with spun inlet bell and shaped cut.
- B. Factory finish before assembly to manufacturer's standard. For fans handling air downstream of humidifiers, provide two additional coats of paint. Prime coating on aluminum parts is not required.
- C. Provide bolted construction with horizontal flanged split housing, where indicated.
- D. Fabricate plug fans without volute housing, in lined steel cabinet. See Section 23 07 13.

2.05 BEARINGS AND DRIVES

- A. Bearings: Heavy duty pillow block type, selfgreasing ball bearings, with ABMA STD 9 life at 100,000 hours.
- B. Shafts: Hot rolled steel, ground and polished, with keyway, protectively coated with lubricating oil, and shaft guard.
- C. Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 15 hp and under, selected so required rpm is obtained with sheaves set at mid Fixed sheave for 20 hp and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.

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Renovation

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- D. 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.

2.06 ACCESSORIES

- A. Fixed Inlet Vanes: Steel construction with fixed cantilevered inlet guide vanes welded to inlet bell.
- B. Adjustable Inlet Vanes: Steel construction with blades supported at both ends with two permanently lubricated bearings, variable mechanism out of air stream terminating in single control lever with control shaft for double width fans and locking quadrant.
- C. Discharge Dampers: Parallel blade heavy duty steel damper assembly with blades constructed of two plates formed around and welded to shaft, channel frame, sealed ball bearings, with blades linked out of air stream to single control lever.
- D. Inlet/Outlet Screens: Galvanized steel welded grid.
- E. Access Doors: Shaped to fit scroll, with quick opening latches and gaskets.
- F. Scroll Drain: 1/2 inch steel pipe coupling welded to low point of fan scroll.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install fans with resilient mountings and flexible electrical leads. See Section 23 05 48.
- C. Install flexible connections between fan inlet and discharge ductwork; see Section 23 33 00. Ensure metal bands of connectors are parallel with minimum one-inch flex between ductwork and fan while running.
- D. Install fan restraining snubbers; see Section 23 05 48. Adjust snubbers to prevent tension in flexible connectors when fan is operating.
- E. Provide fixed sheaves required for final air balance.
- F. Provide safety screen where inlet or outlet is exposed.
- G. Pipe scroll drains to nearest floor drain.
- H. Provide backdraft dampers on discharge of exhaust fans and as indicated; see Section 23 33 00.

END OF SECTION

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SECTION 233423 HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof exhausters.
- B. Roof ventilators.
- C. Wall exhausters.
- D. Cabinet exhaust fans.
- E. Ceiling exhaust fans.
- F. Fire-rated enclosures.
- G. Upblast roof exhausters.
- H. Inline centrifugal fans and blowers.
- I. Kitchen hood upblast roof exhausters.
- J. Utility vent blower sets.
- K. Laboratory and fume exhaust.

1.02 RELATED REQUIREMENTS

- A. Section 23 05 13 - Common Motor Requirements for HVAC Equipment.
- B. Section 23 05 48 - Vibration and Seismic Controls for HVAC.
- C. Section 23 33 00 - Air Duct Accessories: Backdraft dampers.

1.03 REFERENCE STANDARDS

- A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.
- B. AMCA 99 - Standards Handbook; 2016.
- C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2020.
- D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016, with Errata (2018).
- 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 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
- H. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.
- I. UL 762 - Outline of Investigation for Power Roof Ventilators for Restaurant Exhaust Appliances; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
- B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.
- C. Manufacturer's Instructions: Indicate installation instructions.

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- D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.06 QUALITY ASSURANCE

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

1.07 FIELD CONDITIONS

- A. Permanent ventilators may not be used for ventilation during construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Greenheck Fan Corporation; _____: www.greenheck.com/#sle.
- B. Loren Cook Company; _____: www.lorencook.com/#sle.
- C. PennBarry, Division of Air System Components; _____: www.pennbarry.com/#sle.
- D. Twin City Fan & Blower; _____: www.tcf.com/#sle.
- E. Substitutions: See Section 01 60 00 - 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. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.03 ROOF VENTILATORS

- 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: 8 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips.
- C. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor and wall mounted multiple speed switch or solid state speed controller.
- D. Backdraft Damper: Gravity 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 is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.04 WALL EXHAUSTERS

- A. Fan Unit: V-belt or direct driven with spun aluminum housing; resiliently mounted motor; 1/2 inch mesh, 0.062 inch thick aluminum wire bird screen.
- B. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor, and wall mounted multiple speed switch.
- C. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, and line voltage motor drive, power open, spring return.
- D. Sheaves: For V-belt drives, provide cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

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2.05 CABINET EXHAUST FANS

- A. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.
- B. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted solid state speed controller.
- C. Grille: Molded white plastic.
- D. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.06 FIRE-RATED ENCLOSURES

- A. Manufacturers:
 - 1. Fire Rated Product Specialties Corp: www.frpsonline.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Provide as required to preserve fire resistance rating of building elements.

2.07 UPBLAST ROOF EXHAUSTERS

- A. Belt Drive Fan:
 - 1. Fan Wheel:
 - a. Type: Non-overloading, backward inclined centrifugal.
 - b. Material: Aluminum, statically and dynamically balanced.
 - 2. Housing:
 - a. Construct of heavy gauge aluminum including curb cap, windband, and motor compartment.
 - b. Rigid internal support structure.
 - c. One-piece fabricated or fully welded curb-cap base to windband for leak proof construction.
 - d. Construct drive frame assembly of heavy gauge steel, mounted on vibration isolators.
 - e. Provide breather tube for fresh air motor cooling and wiring.
- B. Shafts and Bearings:
 - 1. Fan Shaft:
 - a. Ground and polished steel with anti-corrosive coating.
 - b. First critical speed at least 25 percent over maximum cataloged operating speed.
 - 2. Bearings:
 - a. Permanently sealed or pillow block type.
 - b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
 - c. 100 percent factory tested.
- C. Drive Assembly:
 - 1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower.
 - 2. Belts: Static free and oil resistant.
 - 3. Fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.
 - 4. Motor pulley adjustable for final system balancing.
 - 5. Readily accessible for maintenance.
- D. Disconnect Switches:
 - 1. Factory mounted and wired.
 - 2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: Type 3R.
 - 3. Finish for Painted Steel Enclosures: Provide manufacturer's standard or factory applied gray unless otherwise indicated.
 - 4. Positive electrical shutoff.
 - 5. Wired from fan motor to junction box installed within motor compartment.
- E. Roof Curb: 8 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips, insulation and curb bottom, curb bottom, ventilated double wall, and factory installed nailer strip.
- F. Drain Trough: Allows for single-point drainage of water, grease, and other residues.
- G. Options/Accessories:

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1. Automatic Belt Tensioner: Automatic device that adjusts for correct belt tension for single drives.
2. Birdscreen:
 - a. Provide galvanized steel construction.
 - b. Protects fan discharge.
3. Clean Out Port: Removable grease repellent compression rubber plug allows access for cleaning wheel through windband.
4. Dampers: Provide motorized type.
5. Drain Connection:
 - a. Aluminum construction.
 - b. Allows single-point drainage of grease, water, or other residues.
6. Finishes: Factory primed.
7. Hinge Kit:
 - a. Aluminum hinges.
 - b. Hinges and restraint cables mounted to base (sleeve).
 - c. Allows fan to tilt away for access to wheel and ductwork for inspection and cleaning.
8. Heat Baffle: Prevents heat from radiating into motor compartment.
9. Tie-down Points: Four brackets located on windband secures fan in heavy wind applications.

2.08 INLINE CENTRIFUGAL FANS AND BLOWERS

- A. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch.
- B. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.09 KITCHEN HOOD UPBLAST ROOF EXHAUSTERS

- A. Belt Drive Fan:
 1. Fan Wheel:
 - a. Type: Non-overloading, backward inclined centrifugal.
 - b. Material: Aluminum, statically and dynamically balanced.
 2. Housing:
 - a. Construct of heavy gauge aluminum including curb cap, windband, and motor compartment.
 - b. Rigid internal support structure.
 - c. One-piece fabricated or fully welded curb-cap base to windband for leak proof construction.
 - d. Construct drive frame assembly of heavy gauge steel, mounted on vibration isolators.
 - e. Provide breather tube for fresh air motor cooling and wiring.
- B. Shafts and Bearings:
 1. Fan Shaft:
 - a. Ground and polished steel with anti-corrosive coating.
 - b. First critical speed at least 25 percent over maximum cataloged operating speed.
 2. Bearings:
 - a. Permanently sealed or pillow block type.
 - b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
 - c. 100 percent factory tested.
- C. Drive Assembly:
 1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower.
 2. Belts: Static free and oil resistant.
 3. Fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.
 4. Motor pulley adjustable for final system balancing.
 5. Readily accessible for maintenance.
- D. Disconnect Switches:
 1. Factory mounted and wired.
 2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: Type 3R.
 3. Finish for Painted Steel Enclosures: Provide {CH#100934} unless otherwise indicated.
 4. Positive electrical shutoff.
 5. Wired from fan motor to junction box installed within motor compartment.

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- E. Roof Curb: {CH#100939} high{CH#100940} of {CH#100941} with continuously welded seams, {CH#100942}.
- F. Drain Trough: Allows for single-point drainage of water, grease, and other residues.
- G. Options/Accessories:
 - 1. Automatic Belt Tensioner: Automatic device that adjusts for correct belt tension for single drives.
 - 2. Birdscreen:
 - a. Provide galvanized steel construction.
 - b. Protects fan discharge.
 - 3. Clean Out Port: Removable grease repellent compression rubber plug allows access for cleaning wheel through windband.
 - 4. Roof Curb Extension: Vented curb extension where required for compliance with minimum clearances required by NFPA 96.
 - 5. Drain Connection:
 - a. Aluminum construction.
 - b. Allows single-point drainage of grease, water, or other residues.
 - 6. Finishes: Factory primed.
 - 7. Grease Trap:
 - a. Aluminum.
 - b. Includes drain connection.
 - c. Collects grease residue.
 - 8. Hinge Kit:
 - a. Aluminum hinges.
 - b. Hinges and restraint cables mounted to base (sleeve).
 - c. Allows fan to tilt away for access to wheel and ductwork for inspection and cleaning.
 - 9. Heat Baffle: Prevents heat from radiating into motor compartment.
 - 10. Tie-down Points: Four brackets located on windband secures fan in heavy wind applications.
 - 11. External motor speed controllers for field mounting.

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. Hung Cabinet Fans:
 - 1. Install fans with resilient mountings and flexible electrical leads. See Section 23 05 48.
 - 2. Install flexible connections specified in Section 23 33 00 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.
- E. Provide sheaves required for final air balance.
- F. Install backdraft dampers on inlet to roof and wall exhausters.
- G. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

END OF SECTION

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SECTION 233600 AIR TERMINAL UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single-duct terminal units.
 - 1. Single-duct, variable-volume units.
- B. Fan-powered units.

1.02 RELATED REQUIREMENTS

- A. Section 23 05 48 - Vibration and Seismic Controls for HVAC.
- B. Section 23 09 13 - Instrumentation and Control Devices for HVAC: Thermostats and actuators.
- C. Section 23 09 23 - Direct-Digital Control System for HVAC.
- D. Section 23 09 93 - Sequence of Operations for HVAC Controls.
- E. Section 23 21 13 - Hydronic Piping: Connections to heating coils.
- F. Section 23 31 00 - HVAC Ducts and Casings.
- G. Section 23 82 00 - Convection Heating and Cooling Units: Air coils.
- H. Section 25 14 00 - Integrated Automation Local Control Units: HVAC controllers.

1.03 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 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2017, with Addendum (2022).
- D. ASHRAE Std 130 - Laboratory Methods of Testing Air Terminal Units; 2016.
- E. ASTM A492 - Standard Specification for Stainless Steel Rope Wire; 1995 (Reapproved 2019).
- F. ASTM A603 - Standard Specification for Metallic-Coated Steel Structural Wire Rope; 2019.
- G. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2019.
- H. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete Elements; 2022.
- I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
- K. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2008.
- L. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate air flow, static pressure, and NC designation. Include electrical characteristics and connection requirements.
- C. Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.
 - 1. Include schedules listing discharge and radiated sound power level for each of second through sixth octave bands at inlet static pressures of 1 to 4 inch wg.

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- D. Certificates: Certify that coils are tested and rated in accordance with AHRI 410.
- E. Manufacturer's Installation Instructions: Indicate support and hanging details, installation instructions, recommendations, and service clearances required.
- F. Project Record Documents: Record actual locations of units and locations of access doors required for access of valving.
- G. 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.
- H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

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

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for air terminal units.

PART 2 PRODUCTS

2.01 SINGLE-DUCT, VARIABLE-VOLUME UNITS

- A. Manufacturers:
 - 1. Carrier, a part of UTC Building and Industrial Systems, a unit of United Technologies Corp.: www.commercial.carrier.com/#sle.
 - 2. Krueger-HVAC: www.krueger-hvac.com/#sle.
 - 3. Price Industries, Inc; _____: www.priceindustries.com/#sle.
 - 4. Trane, a brand of Ingersoll Rand: www.trane.com/#sle.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Basis of Design: Trane.
- C. Acoustic Performance Requirements:
 - 1. Sound ratings of air distribution assemblies: Not to exceed 25 NC at a 0.25" static pressure drop across the unit, and the downstream static pressure of 0.5".
- D. 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.
- E. Unit Casing:
 - 1. Minimum 22 gauge, 0.0299 inch galvanized steel.
 - 2. Air Inlet Collar: Provide round, suitable for standard flexible duct sizes.
 - 3. Unit Discharge: Rectangular, with slip-and-drive connections.
 - 4. Acceptable Liners:
 - a. 1/2 inch thick, coated, fibrous-glass complying with ASTM C1071.
 - 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.
- F. 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.

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- a. Air Leakage Past Closed Damper: Maximum two percent of unit maximum airflow at 3 inch wg inlet static pressure, tested in accordance with ASHRAE Std 130.
- G. 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 and insulated located on bottom, on top, and downstream of coils.
 - b. Right or left coil inlets.
 2. Coil Fins: Aluminum or aluminum plated 0.0045 inch fins, mechanically-bonded to seamless 0.50 by 0.016 inch copper tubes.
 - a. Fins to be formed in a high heat transfer sine wave configuration.
 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.
- H. Controls:
1. DDC (Direct-Digital Controls):
 - a. Basis of Design: Trane.
 - 1) The unit level controller to include the following:
 - (a) 24 VAC power terminal or RJ-12 Power connection.
 - (b) T-Stat Port for thermostat connection.
 - (c) Service Port for Price Linker diagnostic equipment.
 - (d) Damper actuator.
 - (e) Fan output connection.
 - (f) LED indication for troubleshooting.
 - (g) Three binary staged heating outputs.
 - (h) Binary cooling output.
 - (i) S.A.T. sensor input.
 - (j) Contact closure input.
 - (k) Four analog outputs.
 - b. Include a factory-installed, unit-mounted, direct-digital controller.
 - c. Bi-directional Damper Actuator: 24 volt, powered closed, spring return open.
 - d. Microprocessor-Based Controller: Air volume controller, pressure-independent with electronic airflow transducers, factory-calibrated maximum and minimum CFM's.
 - 1) Occupied and unoccupied operating mode.
 - 2) Remote reset of temperature or CFM set points.
 - 3) Proportional, plus integral control of room temperature.
 - 4) Monitoring and adjusting with portable terminal.
 - e. Room Sensor:
 - 1) Compatible with temperature controls specified.
 - 2) Wall-mounted, system powered, with temperature set-point adjustment including connection access for portable operator terminal.
 - f. See Section 25 1400.
 2. Airflow Sensor: Differential pressure airflow device measuring total, static, and wake pressures.
 - a. Basis of Design: Trane.
 - 1) Plastic parts are fire-resistant, complying with UL 94.
 - 2) Provides accuracy within 5 percent with a 90 degree sheet metal elbow directly at the inlet of the assembly.
 - 3) Control tubing is protected by grommets at the wall of the air flow sensor's housing.
 - 4) Furnished with twelve total pressure sensing ports and a center averaging chamber that amplifies the sensed air flow signal.
 - 5) Provide sensor with a pressure transducer to interface with a DDC system.
 - 6) Provide velocity pressure sensor with a removable access section for maintenance.
 - b. Signal accuracy: Plus/minus five percent throughout terminal operating range.
 3. Control Sequence:
 - a. Suitable for operation with duct pressures between 0.25 and 3.0 inch wg inlet static pressure.
 - b. Include factory-mounted and piped, 5-micron filter; and adjustable, velocity-resetting, high-limit control with amplifying relay.
 - c. See Section 23 09 93.

2.02 FAN-POWERED PARALLEL UNITS

- A. Manufacturers:
1. Carrier, a part of UTC Building and Industrial Systems, a unit of United Technologies Corp.:
www.commercial.carrier.com/#sle.
 2. Krueger-HVAC: www.krueger-hvac.com/#sle.

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3. Price Industries, Inc: www.priceindustries.com/#sle.
 4. Trane, a brand of Ingersoll Rand: www.trane.com/#sle.
- B. Basis of Design: Trane.
- C. General:
1. Factory-assembled and wired, AHRI 880 (I-P) rated, horizontal fan-powered terminal unit with blower, blower motor, mixing plenum, and primary air damper contained in a single unit housing.
- D. Unit Casing:
1. Minimum 22 gauge, 0.0299 inch galvanized steel.
 2. Primary Air Inlet Collar: Suitable for standard flexible duct sizes.
 3. Unit Discharge: Rectangular, suitable for flanged duct connection.
 4. Plenum Inlet: Filter rack with disposable filters.
 - a. 1 inch thick disposable fiberglass filters.
 - b. Minimum Efficiency Reporting Value (MERV): 8, when tested in accordance with ASHRAE Std 52.2.
 5. Acceptable Liners:
 - a. 1/2 inch thick, coated, fibrous-glass complying with ASTM C1071.
 - 1) Secure with adhesive.
 - 2) Coat edges exposed to airstream with NFPA 90A approved sealant.
 - 3) Cover liner with non-porous foil.
- E. Primary Air Damper Assembly:
1. Heavy-gauge, galvanized steel or extruded aluminum construction with solid shaft rotating in bearings.
 2. Provide indicator on damper shaft or alternative method for indicating damper position over full range of 90 degrees.
 3. Incorporate low leak (2 percent) damper blades for tight airflow shutoff.
 4. Fan(s): Forward curved, centrifugal type.
 5. Fan Motor:
 - a. ECM (Electrically Commutated Motor):
 - 1) Brushless DC controlled by an integrated controller/inverter that operates the wound stator and senses rotor position to electrically commutate the stator.
 - b. Fan motor shaft directly connected to fan and and isolated from unit casing to prevent transmission of vibration.
- F. Hot Water Heating Coil:
1. Coil Casing: Minimum 22 gauge, 0.0299 inch galvanized steel, factory-installed on terminal unit with flanged discharge for attachment to downstream ductwork.
 2. Heavy-gauge aluminum fins, mechanically bonded to tubes.
 3. Copper Tubes: 0.016 inch minimum wall thickness with male solder header connections.
 4. Coil leak tested to minimum 305 psig.
 5. Base performance data on tests run in accordance with AHRI 410.
- G. Electrical Requirements:
1. Single-point power connection.
 2. Equipment wiring to comply with requirements of NFPA 70.
- H. Controls:
1. DDC (Direct-Digital Controls):
 - a. Basis of Design: Trane.
 - 1) The unit level controller to include the following:
 - (a) 24 VAC power terminal or RJ-12 Power connection.
 - (b) T-Stat Port for thermostat connection.
 - (c) Service Port for Price Linker diagnostic equipment.
 - (d) Damper actuator.
 - (e) Fan output connection.
 - (f) LED indication for troubleshooting.
 - (g) Three binary staged heating outputs.
 - (h) Binary cooling output.
 - (i) S.A.T. sensor input.
 - (j) Contact closure input.
 - (k) Four analog outputs.
 - b. Include a factory-installed, unit-mounted, direct-digital controller.
 - c. Bi-directional Damper Actuator: 24 volt, powered closed, spring return open.

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- d. Microprocessor-Based Controller: Air volume controller, pressure-independent with electronic airflow transducers, factory-calibrated maximum and minimum CFM's.
 - 1) Occupied and unoccupied operating mode.
 - 2) Remote reset of temperature or CFM set points.
 - 3) Proportional, plus integral control of room temperature.
 - 4) Monitoring and adjusting with portable terminal.
- e. Room Sensor:
 - 1) Compatible with temperature controls specified.
 - 2) Wall-mounted, system powered, with temperature set-point adjustment including connection access for portable operator terminal.
2. Airflow Sensor: Differential pressure airflow device measuring total, static, and wake pressures.
 - a. Basis of Design: Trane.
 - 1) Plastic parts are fire-resistant, complying with UL 94.
 - 2) Provides accuracy within 5 percent with a 90 degree sheet metal elbow directly at the inlet of the assembly.
 - 3) Control tubing is protected by grommets at the wall of the air flow sensor's housing.
 - 4) Furnished with twelve total pressure sensing ports and a center averaging chamber that amplifies the sensed air flow signal.
 - 5) Provide sensor with a pressure transducer to interface with a DDC system.
 - 6) Provide velocity pressure sensor with a removable access section for maintenance.
 - b. Signal accuracy: Plus/minus five percent throughout terminal operating range.
3. Control Sequence: See Section 23 09 93.

2.03 HOSE KITS AND VALVES

- A. Manufacturers:
 1. Griswold Controls: www.griswoldcontrols.com/#sle.
 2. Hays Fluid Controls: www.haysfluidcontrols.com/#sle.
 3. Substitutions: See Section 01 60 00 - Product Requirements.
- 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.
 4. Automatic Balancing Valves:
 5. Brass body for shutoff and hydronic balancing.
 6. Ball Valves:
 7. Brass body for shutoff and hydronic balancing.
 8. Material: Braided stainless steel rated to minimum 400 psi at 265 degrees F.
- C. Ball Valves:
 1. Brass body for shutoff and hydronic balancing.

PART 3 EXECUTION

3.01 BALL VALVES:

1. Brass body for shutoff and hydronic balancing.

3.02 EXAMINATION

1. Provide pressure/temperature ports.
- B. Y Strainers:
 1. Bronze body.
 2. "Y" type configuration with brass cap.
- C. Verify that conditions are suitable for installation.
 1. Maximum Operating Pressure: Minimum 450 psi.
 2. Screen: Stainless steel.
- D. Verify that field measurements are as indicated on drawings.

3.03 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.

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- 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. Embed anchors in concrete in accordance with ASTM E488/E488M.
- G. Do not support from ductwork.
- H. Connect to ductwork in accordance with Section 23 31 00.
- I. Provide minimum of 5 ft of 1 inch thick lined ductwork downstream of units.
- J. Install heating coils in accordance with Section 23 82 00.
- K. Verify that electric power is available and of the correct characteristics.

3.04 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. Set units with heating coils for minimum 35 percent full flow.

3.05 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Provide manufacturer's field representative to test, inspect, instruct, and observe field-assembled components and equipment installation, including connections and to assist in field testing. Report results in writing.
 - 1. Leak Test:
 - a. After installation, fill water coils and test for leaks.
 - b. Repair leaks and retest until no leaks exist.
 - 2. Operational Test:
 - a. After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - b. Test and adjust controls and safeties.
 - c. Replace damaged and malfunctioning controls and other equipment.
 - d. Remove and replace malfunctioning units and retest as specified above.

3.06 CLEANING

- A. Vacuum clean coils and inside of units.
- B. Install new filters.

3.07 CLOSEOUT ACTIVITIES

- A. See Section 01 79 00 - Demonstration and Training, for additional requirements.

END OF SECTION

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SECTION 233700 AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Diffusers:
 - 1. Critical environment diffusers.
- B. Rectangular ceiling diffusers.
 - 1. Round ceiling diffusers.
 - 2. Slot ceiling diffusers.
- C. Registers/grilles:
 - 1. Floor-mounted, linear supply register/grilles.
 - 2. Floor-mounted, supply register/grilles.
 - 3. Ceiling-mounted, egg crate exhaust and return register/grilles.
 - 4. Ceiling-mounted, exhaust and return register/grilles.
 - 5. Ceiling-mounted, linear exhaust and return register/grilles.
 - 6. Ceiling-mounted, supply register/grilles.
 - 7. Wall-mounted, supply register/grilles.
 - 8. Wall-mounted, linear register/grilles.
- D. Wall and ceiling gypsum board access panels with return air grilles.
- E. Duct-mounted supply and return registers/louvers.
- F. Fabric air distribution devices.
- G. Door grilles.
- H. Louvers:
- I. Louvered penthouses.
- J. Roof hoods.
- K. Goosenecks.
- L. Gravity ventilators.
- M. Fire-rated enclosures.

1.02 RELATED REQUIREMENTS

- A. Section 09 91 23 - Interior Painting: Painting of ducts visible behind outlets and inlets.

1.03 REFERENCE STANDARDS

- A. AMCA 511 - Certified Ratings Program Product Rating Manual for Air Control Devices; 2021, with Editorial Revision (2022).
- B. AMCA 550 - Test Method for High Velocity Wind Driven Rain Resistant Louvers; 2022.
- C. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Air Inlets; 2023.
- D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- G. ISO 14644-1 - Cleanrooms and Associated Controlled Environments - Part 1: Classification of Air Cleanliness by Particle Concentration; 2015.
- H. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
- I. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.
- J. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.
- K. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

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- L. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.
- M. UL 2518 - Standard for Safety Air Dispersion Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. 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.
- C. Project Record Documents: Record actual locations of air outlets and inlets.

1.05 QUALITY ASSURANCE

- A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.
- B. 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: www.krueger-hvac.com/#sle.
- B. Metalaire, a brand of Metal Industries Inc: www.metalaire.com/#sle.
- C. Price Industries: www.price-hvac.com/#sle.
- D. Titus, a brand of Air Distribution Technologies: www.titus-hvac.com/#sle.
- E. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ROUND CEILING DIFFUSERS

- A. Type: Round, adjustable pattern, stamped or spun, multi-core diffuser to discharge air in 360 degree pattern, with sectorizing baffles where indicated. Diffuser collar shall project not more than 1 inch above ceiling. In plaster ceilings, provide plaster ring and ceiling plaque.
- B. Fabrication: Steel with baked enamel finish.
- C. Color: As indicated on drawings.
- D. Accessories: Radial opposed blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face.

2.03 RECTANGULAR CEILING DIFFUSERS

- A. Type: Provide square and rectangular, adjustable pattern diffuser to discharge air in four way pattern with sectorizing baffles where indicated.
- B. Connections: Round.
- C. Frame: Provide surface mount, snap-in, inverted T-bar, and spline type. In plaster ceilings, provide plaster frame and ceiling frame.
- D. Fabrication: Steel with baked enamel finish.
- E. Color: As indicated.
- F. Accessories: Provide radial opposed blade, butterfly, and combination splitter volume control damper; removable core with damper adjustable from diffuser face.

2.04 CEILING SLOT DIFFUSERS

- A. Type: Continuous 1/2 inch wide slot, 1 slots wide, with adjustable vanes for left, right, or vertical discharge.
- B. Fabrication: Aluminum extrusions with factory clear lacquer finish.
- C. Color: As indicated.
- D. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket, mitered end border.

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E. Plenum: Integral, galvanized steel, insulated.

2.05 DUCT-MOUNTED SUPPLY AND RETURN REGISTERS/LOUVERS

- A. Type: Duct-mounted, rectangular register for round-spiral duct with adjustable pivot-ended blades, end caps, built-in volume damper, and dual cover flanges to lay flush on duct surface regardless of diameter. Performance to match manufacturer's catalog data.
- B. Material: 22 gauge, 0.0299 inch.
 - 1. Provide crossing spiral fitting-body of matching duct diameter.
- C. Color: As indicated on drawings.

2.06 CEILING SUPPLY REGISTERS/GRILLES

- A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, two-way deflection.
- B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.
- C. Construction: Made of aluminum extrusions with factory enamel finish.
- D. Color: As indicated.
- E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.07 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 countersunk screw 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: As indicated.
- E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans.
- F. Gymnasiums: Provide front pivoted or welded in place blades, securely fastened to be immobile.

2.08 CEILING LINEAR EXHAUST AND RETURN GRILLES

- A. Type: Streamlined blades with 90 degree one-way deflection, 1/8 by 3/4 inch on 1/4 inch centers.
- B. Frame: 1-1/4 inch margin, extra heavy for floor mounting, with countersunk screw 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: As indicated.
- E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.09 CEILING EGG CRATE EXHAUST AND RETURN GRILLES

- A. Type: Egg crate style face consisting of 1/2 by 1/2 by 1 inch grid core.
- B. Fabrication: Grid core consists of aluminum with mill aluminum finish.
- C. Color: As indicated.
- D. Frame: 1-1/4 inch margin with countersunk screw mounting.
- E. Frame: Channel lay-in frame for suspended grid ceilings.
- F. Accessories: Provide 45 degree angled eggcrate or other similar provisions for visual blocking such as angled louver, 90 degree duct elbow, etc..

2.10 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.

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- 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: As indicated.
- E. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.
- F. Gymnasiums: Provide front pivoted or welded in place blades, securely fastened to be immobile.

2.11 LINEAR WALL REGISTERS/GRILLES

- A. Type: Streamlined blades with 0 degree deflection, 1/8 by 3/4 inch on 1/4 inch centers.
- B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.
- C. Fabrication: Aluminum extrusions, with factory baked enamel finish.
- D. Color: As indicated.
- E. Damper: Integral gang-operated opposed blade damper with removable key operator, operable from face.

2.12 LINEAR FLOOR SUPPLY REGISTERS/GRILLES

- A. Type: Streamlined blades with 15 degree deflection, 1/8 by 3/4 inch on 1/4 inch centers, assembled on expanded tubes mandrel construction.
- B. Frame: 1-1/4 inch heavy margin frame with countersunk screw mounting, and mounting frame.
- C. Fabrication: Aluminum extrusions with factory baked enamel finish.
- D. Color: As indicated.
- E. Damper: Integral gang-operated opposed blade damper with removable key operator, operable from face.

2.13 CRITICAL ENVIRONMENTS DIFFUSERS

- A. General Requirements:
 - 1. Diffuser material to comply with ASTM E84, UL 723, UL 2518, NFPA 90A, and NFPA 90B.
- B. Laminar Flow Diffusers:
 - 1. Construction: Stainless steel.
 - 2. Frame: Provide framing per manufacturer's recommendations.
 - 3. Dimensions: As indicated.
 - 4. Color: As indicated on drawings.
 - 5. Damper: Provide volume control per manufacturer's recommendations.

2.14 FABRIC AIR DISTRIBUTION DEVICES

- A. Manufacturers:
 - 1. DuctSox Corporation: www.ductsox.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. General Requirements:
 - 1. Diffuser material to comply with ASTM E84, UL 723, UL 2518, NFPA 90A, and NFPA 90B.
 - 2. Fabrics to comply with ISO 14644-1 for ISO Class 4 application (clean room, non-shedding material).
 - 3. Provide fabric air distribution devices made of 100 percent post-consumer recycled content polyester verified by a third party.
 - 4. Fabric air distribution devices must be designed in software which documents, calculates and provides pressure loss, inlet velocity, turbulent condition warnings, throw capability, entrainment, deflection, flow models, sizing, installation methods, sound generated and temperature corrections.
 - 5. Textile material must be documented to have the ability to dissipate static electricity (anti-static properties).
- C. Continuous Diffusers:
 - 1. Fabric: 100 percent flame retardant polyester treated with an antimicrobial agent from manufacturer.
 - 2. Shape: Round.
 - 3. Frame: Provide framing per manufacturer's recommendations.
 - 4. Dimensions: As indicated.

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5. Color: As indicated.

2.15 FLOOR SUPPLY REGISTERS/GRILLES

- A. Individually adjustable blades, wide stamped border, single or double blade damper with set screw adjustment.
- B. Fabricate of steel, welded construction, with factory baked enamel finish.

2.16 DOOR GRILLES

2.17 LOUVERS

- A. Type: 6 inch deep with blades on 45 degree slope with center baffle and return bend, heavy channel frame, 1/2 inch square mesh screen over exhaust and 1/2 inch square mesh screen over intake.
- B. Fabrication: 16 gauge, 0.0598 inch (1.52 mm) thick galvanized steel thick galvanized steel welded assembly, with factory prime coat finish.
- C. Color: As indicated on the drawings.
- D. Mounting: Furnish with exterior angle flange for installation.

2.18 LOUVERED PENTHOUSES

2.19 ROOF HOODS

- A. Fabricate air inlet or exhaust hoods in accordance with SMACNA (DCS).
- B. Fabricate of galvanized steel, minimum 16 gauge, 0.0598 inch base and 20 gauge, 0.0359 inch hood, or aluminum, minimum 16 gauge, 0.0598 inch base and 18 gauge, 0.0598 inch hood; suitably reinforced; with removable hood; birdscreen with 1/2 inch square mesh for exhaust and 3/4 inch for intake, and factory prime coat finish.
- C. Fabricate louver penthouses with mitered corners and reinforce with structural angles.
- D. Mount unit on minimum 12 inch high curb base with insulation between duct and curb.
- E. Make hood outlet area minimum of twice throat area.

2.20 GOOSENECKS

- A. Fabricate in accordance with of minimum 18 gauge, 0.0598 inch galvanized steel.
- B. Mount on minimum 12 inch high curb base where size exceeds 9 by 9 inch.

2.21 GRAVITY VENTILATORS

- A. Hood Intake and Relief Gravity Ventilator:
 1. General:
 - a. Low silhouette for intake applications with natural gravity or negative pressure system(s).
 - b. Performance ratings and factory testing to be in accordance with AMCA 511 and AMCA 550.
 - c. Suitable for non-ducted applications.
 2. Hood and Base:
 - a. Material: Galvanized steel.
 - b. Hood Construction: Precision formed, arched panels with interlocking seams.
 - c. Vertical End Panels: Fully locked into hood end panels.
 - d. Curb Cap: Pre-punched mounting holes for installation.
 3. Birdscreen:
 - a. Fabricate in accordance with ASTM B221 (((ASTM B221M))).
 - b. Construction: 1/2 inch Galvanized mesh.
 - c. Horizontally mounted across hood intake area.
 4. Hood Support: Galvanized steel construction and fastened so hood can be removed completely from the base or hinged open.
 5. Options/Accessories:
 - a. Roof Curbs:
 - 1) Flat Roofs:
 - (a) Welded, straight side curb with flashing flange and wood nailer.
 - (b) Tabbed and riveted curb with 45 degree cant and wood nailer.
 - (c) Welded curb with 45 degree cant and wood nailer.
 - 2) Pitched Roofs: Welded, straight side curb with flashing flange and wood nailer.

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- 3) Material: Galvanized.
- 4) Insulation Thickness: 1 inch.
- b. Provide extended base minimum 7 inch extension to base height making overall base 12 inches in height to prevent snow or moisture intake.
- c. Curb Seal: Rubber seal between fan and roof curb.
- d. Dampers:
 - 1) Type: Motorized.
 - 2) Factory designed to prevents outside air from entering back into building when fan is off.
 - 3) Balanced for minimal resistance to flow.
 - 4) Galvanized frames with pre-punched mounting holes.
- e. Factory Finish: Factory primed for field application of final finish.
- f. Hood Insulation or Coating: Provide 1/2 inch fiberglass insulation lining or anti-condensate coating to prevent condensation and reduce sound levels.
- g. Insect Screen:
 - 1) Fabricate in accordance with ASTM B221 ((ASTM B221M))).
 - 2) Construct of fine mesh aluminum.
 - 3) Fitted to top of the throat to prevent entry of insects.
 - 4) Coating: Thermo-setting polyester urethane.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Comply with SMACNA (ASMM) for flashing/counter-flashing of roof penetrations and supports for roof curbs and roof mounted equipment.
- C. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.
- D. Install diffusers to ductwork with air tight connection.
- E. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- F. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 91 23.

END OF SECTION

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SECTION 260505 SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical demolition.

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 circuiting arrangements are as indicated.
- B. Verify that abandoned wiring and equipment serve only abandoned facilities.
- C. Demolition drawings are based on casual field observation and existing record documents.
- D. Report discrepancies to Owner before disturbing existing installation.
- E. Report discrepancies to Architect before disturbing existing installation.
- F. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

- A. Disconnect electrical systems in walls, floors, and ceilings to be removed.
- B. Coordinate utility service outages with utility company.
- C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
- D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
 - 1. Obtain permission from Owner at least 24 hours before partially or completely disabling system.
 - 2. Make temporary connections to maintain service in areas adjacent to work area.
- E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Minimize outage duration.
 - 1. Notify Owner before partially or completely disabling system.
 - 2. Make notifications at least 24 hours in advance.
 - 3. Make temporary connections to maintain service in areas adjacent to work area.
- F. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
 - 1. Notify Owner at least 24 hours before partially or completely disabling system.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
 - 1. PCB-containing electrical equipment, including transformers, capacitors, and switches.
 - 2. PCB- and DEHP-containing lighting ballasts.
 - 3. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Remove abandoned wiring to source of supply.
- D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

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- E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.
- F. Disconnect and remove abandoned panelboards and distribution equipment.
- G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
- I. Repair adjacent construction and finishes damaged during demolition and extension work.
- J. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
- K. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.04 CLEANING AND REPAIR

- A. See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.
- B. Clean and repair existing materials and equipment that remain or that are to be reused.
- C. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

END OF SECTION

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SECTION 260519 LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single conductor building wire.
- B. Nonmetallic-sheathed cable.
- C. Underground feeder and branch-circuit cable.
- D. Service entrance cable.
- E. Armored cable.
- F. Metal-clad cable.
- G. Power and control tray cable.
- H. Manufactured wiring systems.
- I. Wiring connectors.
- J. Electrical tape.
- K. Heat shrink tubing.
- L. Oxide inhibiting compound.
- M. Wire pulling lubricant.
- N. Cable ties.
- O. Firestop sleeves.

1.02 RELATED REQUIREMENTS

- A. Section 07 84 00 - Firestopping.
- B. Section 26 05 05 - Selective Demolition for Electrical: Disconnection, removal, and/or extension of existing electrical conductors and cables.
- C. Section 26 05 19.13 - Undercarpet Electrical Power Cables: Flat conductor cable and fittings for undercarpet power distribution.
- D. Section 26 05 26 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
- E. Section 26 05 36 - Cable Trays for Electrical Systems: Additional installation requirements for cables installed in cable tray systems.
- F. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- G. Section 26 21 00 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conductors.
- H. Section 26 31 00 - Photovoltaic Collectors: Additional wiring requirements for photovoltaic systems.
- I. Section 28 46 00 - Fire Detection and Alarm: Fire alarm system conductors and cables.
- J. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.04 REFERENCE STANDARDS

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2018).
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2023.

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- 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. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2017.
- H. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2020.
- I. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- J. NECA 104 - Standard for Installing Aluminum Building Wire and Cable; 2012.
- K. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable; 2018.
- L. NECA 121 - Standard for Installing Nonmetallic-Sheathed Cable (Type NM-B) and Underground Feeder and Branch-Circuit Cable (Type UF); 2007.
- M. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.
- N. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- O. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.
- P. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.
- Q. UL 183 - Manufactured Wiring Systems; Current Edition, Including All Revisions.
- R. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.
- S. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.
- T. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.
- U. UL 493 - Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables; Current Edition, Including All Revisions.
- V. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.
- W. UL 719 - Nonmetallic-Sheathed Cables; Current Edition, Including All Revisions.
- X. UL 854 - Service-Entrance Cables; Current Edition, Including All Revisions.
- Y. UL 1277 - Electrical Power and Control Tray Cables with Optional Optical-Fiber Members; Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 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. Manufactured wiring systems are permitted only as follows:
 - 1. Where not otherwise restricted, may be used:
 - a. For branch circuits where concealed under raised floors, where concealed above accessible ceilings for lighting, and in open ceiling areas for lighting.
 - 1) Exception: Provide single conductor building wire in raceway for circuit homerun from distribution box to panelboard.

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2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- D. Comply with NEMA WC 70.
- E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- G. Conductor Material:
 - 1. Provide copper conductors except where aluminum conductors are specifically indicated. Substitution of aluminum conductors for copper is not permitted. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
 - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
 - 3. Tinned Copper Conductors: Comply with ASTM B33.
 - 4. 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.
- H. Minimum Conductor Size: 12 AWG.
- I. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- J. Conductor Color Coding:
 - 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
 - 2. Color Coding Method: Integrally colored insulation.
 - 3. Color Code:
 - a. 480Y/277 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - 4) Neutral/Grounded: Gray.
 - b. 208Y/120 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Neutral/Grounded: White.
 - c. 240/120 V High-Leg Delta, 3 Phase, 4 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B (High-Leg): Orange.
 - 3) Phase C: Blue.
 - 4) Neutral/Grounded: White.
 - d. Equipment Ground, All Systems: Green.
 - e. 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.

2.03 SINGLE CONDUCTOR BUILDING WIRE

- A. Manufacturers:
 - 1. Copper Building Wire:
 - a. Cerro Wire LLC: www.cerrowire.com/#sle.
 - b. Encore Wire Corporation: www.encorewire.com/#sle.
 - c. General Cable Technologies Corporation: www.generalcable.com/#sle.
 - d. Southwire Company: www.southwire.com/#sle.
 - 2. Aluminum Building Wire (only where specifically indicated or permitted for substitution):

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- a. Encore Wire Corporation: www.encorewire.com/#sle.
 - b. Southwire Company: www.southwire.com/#sle.
 - c. Stabiloy, a brand of General Cable Technologies Corporation: www.stabiloy.com/#sle.
- B. Description: Single conductor insulated wire.
- C. Conductor Stranding:
- 1. Feeders and Branch Circuits:
 - a. Size 10 AWG and Smaller: Solid.
 - b. Size 8 AWG and Larger: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation:
- 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
 - a. Size 4 AWG and Larger: Type XHHW-2.
 - b. Installed Underground: Type XHHW-2.

2.04 NONMETALLIC-SHEATHED CABLE

- A. Manufacturers:
- 1. Cerro Wire LLC: www.cerrowire.com/#sle.
 - 2. Encore Wire Corporation: www.encorewire.com/#sle.
 - 3. Southwire Company: www.southwire.com/#sle.
- B. Description: NFPA 70, Type NM multiple-conductor cable listed and labeled as complying with UL 719, Type NM-B.
- C. Conductor Stranding:
- 1. Size 10 AWG and Smaller: Solid.
 - 2. Size 8 AWG and Larger: Stranded.
- D. Insulation Voltage Rating: 600 V.

2.05 UNDERGROUND FEEDER AND BRANCH-CIRCUIT CABLE

- A. Manufacturers:
- 1. Cerro Wire LLC: www.cerrowire.com/#sle.
 - 2. Encore Wire Corporation: www.encorewire.com/#sle.
 - 3. Southwire Company: www.southwire.com/#sle.
- B. Description: NFPA 70, Type UF multiple-conductor cable listed and labeled as complying with UL 493, Type UF-B.
- C. Provide equipment grounding conductor unless otherwise indicated.
- D. Conductor Stranding:
- 1. Size 10 AWG and Smaller: Solid.
 - 2. Size 8 AWG and Larger: Stranded.
- E. Insulation Voltage Rating: 600 V.
- F. Cable Jacket: Listed and labeled as sunlight resistant.

2.06 SERVICE ENTRANCE CABLE

- A. Manufacturers:
- 1. Copper Service Entrance Cable:
 - a. Cerro Wire LLC: www.cerrowire.com/#sle.
 - b. Encore Wire Corporation: www.encorewire.com/#sle.
 - c. Southwire Company: www.southwire.com/#sle.
 - 2. Aluminum Service Entrance Cable:
 - a. Encore Wire Corporation: www.encorewire.com/#sle.
 - b. General Cable Technologies Corporation: www.generalcable.com/#sle.
 - c. Southwire Company: www.southwire.com/#sle.
 - d. Stabiloy, a brand of General Cable Technologies Corporation: www.stabiloy.com/#sle.
- B. Service Entrance Cable for Underground Use: NFPA 70, Type USE single-conductor cable listed and labeled as complying with UL 854, Type USE-2, and with UL 44 Type RHH/RHW-2.

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- C. Conductor Stranding: Stranded.
- D. Insulation Voltage Rating: 600 V.

2.07 POWER AND CONTROL TRAY CABLE

- A. Manufacturers:
 - 1. Encore Wire Corporation: www.encorewire.com/#sle.
 - 2. General Cable Technologies Corporation: www.generalcable.com/#sle.
 - 3. Okonite: www.okonite.com/#sle.
 - 4. Southwire Company: www.southwire.com/#sle.
- B. Description: NFPA 70, Type TC cable listed and labeled as complying with UL 1277.
- C. Conductor Stranding: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation: Type XHHW or XHHW-2.
- F. Jacket: PVC or Chlorinated Polyethylene (CPE).

2.08 MANUFACTURED WIRING SYSTEMS

- A. Manufacturers:
 - 1. AFC Cable Systems Inc: www.afcweb.com/#sle.
 - 2. D&P Custom Lights & Wiring Systems, Inc: www.dandpcustomlights.com/#sle.
 - 3. RELOC Wiring Solutions, a brand of Acuity Brands, Inc: www.relocwiring.com/#sle.
 - 4. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/#sle.
- B. Description: Manufactured wiring assemblies complying with NFPA 70 Article 604, and listed and labeled as complying with UL 183.
- C. Provide components necessary to transition between manufactured wiring system and other wiring methods.
- D. Branch Circuit Cables:
 - 1. Conductor Stranding (Size 10 AWG and Smaller): Solid.
 - 2. Insulation Voltage Rating: 600 V.
 - 3. Insulation: Type THHN.
 - 4. Grounding: Full-size integral equipment grounding conductor.
 - 5. Armor: Steel, interlocked tape.
- E. Connectors: Keyed and color-coded to prevent interconnection of different voltages.
- F. Fixture Leads: Type TFN insulation.

2.09 WIRING CONNECTORS

- A. 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.
- B. Connectors for Grounding and Bonding: Comply with Section 26 05 26.
- C. Wiring Connectors for Splices and Taps:
 - 1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
 - 2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
- D. Wiring Connectors for Terminations:
 - 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
 - 2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
 - 3. 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.
 - 4. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.

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5. Aluminum Conductors: Use compression connectors for all connections.
- E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
- F. 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.
- G. Mechanical Connectors: Provide bolted type or set-screw type.
 1. Manufacturers:
 - a. Burndy LLC: www.burndy.com/#sle.
 - b. IlSCO: www.ilSCO.com/#sle.
 - c. Thomas & Betts Corporation: www.tnb.com/#sle.
- H. Compression Connectors: Provide circumferential type or hex type crimp configuration.
 1. Manufacturers:
 - a. Burndy LLC: www.burndy.com/#sle.
 - b. IlSCO: www.ilSCO.com/#sle.
 - c. Thomas & Betts Corporation: www.tnb.com/#sle.
- I. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
 1. Manufacturers:
 - a. Burndy LLC: www.burndy.com/#sle.
 - b. IlSCO: www.ilSCO.com/#sle.
 - c. Thomas & Betts Corporation: www.tnb.com/#sle.

2.10 ACCESSORIES

- A. Electrical Tape:
 1. Manufacturers:
 - a. 3M: www.3m.com/#sle.
 - b. Plymouth Rubber Europa: www.plymouthrubber.com/#sle.
 2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
 3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
 4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
- B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
 1. Manufacturers:
 - a. 3M: www.3m.com/#sle.
 - b. Burndy LLC: www.burndy.com/#sle.
 - c. Thomas & Betts Corporation: www.tnb.com/#sle.
- C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
 1. Manufacturers:
 - a. Burndy LLC: www.burndy.com/#sle.
 - b. Ideal Industries, Inc: www.idealindustries.com/#sle.
 - c. IlSCO: www.ilSCO.com/#sle.
- D. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
- E. Cable Ties: Material and tensile strength rating suitable for application.
- F. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for cables and roofing system to be installed; designed to accommodate existing penetrations where applicable.

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- G. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

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. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
 - 3. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
 - 4. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
 - a. Increase size of conductors as required to account for ampacity derating.
 - 5. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three 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 nonmetallic-sheathed cable (Type NM-B) in accordance with NECA 121.
- F. Install underground feeder and branch-circuit cable (Type UF-B) in accordance with NECA 121.
- G. Install metal-clad cable (Type MC) in accordance with NECA 120.
- H. 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.
- I. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- J. 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.
- K. 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.
- L. Install conductors with a minimum of 12 inches of slack at each outlet.
- M. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

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- 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 contaminates. 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. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
- S. 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.

END OF SECTION

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SECTION 260526 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 RELATED REQUIREMENTS

- A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
- B. Section 26 05 36 - Cable Trays for Electrical Systems: Additional grounding and bonding requirements for cable tray systems.
- C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 31 00 - Photovoltaic Collectors: Additional grounding and bonding requirements for photovoltaic systems.
- E. Section 26 56 00 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

1.03 REFERENCE STANDARDS

- A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2022.
- D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
- E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. NFPA 99 - Health Care Facilities Code; 2024, with Errata.
- G. NFPA 780 - Standard for the Installation of Lightning Protection Systems; 2023.
- H. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
 - 2. Notify Architect 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.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

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1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.07 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 Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
 - 2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
- 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. 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.
 - 3. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
 - 4. 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. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.
- G. Separately Derived System Grounding:
 - 1. Separately derived systems include, but are not limited to:
 - a. Transformers (except autotransformers such as buck-boost transformers).
 - b. Uninterruptible power supplies (UPS), when configured as separately derived systems.
 - c. Generators, when neutral is switched in the transfer switch.
 - 2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
 - 3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
 - 4. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.

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5. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.
- H. 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 metal building frame.
 8. Provide bonding and equipment grounding for pools and fountains and associated equipment in accordance with NFPA 70.
- I. Isolated Ground System:
1. Where isolated ground receptacles or other isolated ground connections are indicated, provide separate isolated/insulated equipment grounding conductors.
 2. Connect isolated/insulated equipment grounding conductors only to separate isolated/insulated equipment ground busses.
 3. Connect the isolated/insulated equipment grounding conductors to the solidly bonded equipment ground bus only at the service disconnect or separately derived system disconnect. Do not make any other connections between isolated ground system and normal equipment ground system on the load side of this connection.
- 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.
- K. Lightning Protection Systems:
1. Do not use grounding electrode dedicated for lightning protection system for component of building grounding electrode system provided under this section.
 2. Provide bonding of building grounding electrode system provided under this section and lightning protection grounding electrode system in accordance with NFPA 70 and NFPA 780.
- L. Cable Tray Systems: Also comply with Section 26 05 36.
- M. Photovoltaic Systems: Also comply with Section 26 31 00.
- N. Pole-Mounted Luminaires: Also comply with Section 26 56 00.

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 05 26:
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.
 3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

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- 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.
- D. 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.
- E. Identify grounding and bonding system components in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - 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.

END OF SECTION

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SECTION 260529 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

1.03 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with applicable building code.

1.04 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.
- D. MFMA-4 - Metal Framing Standards Publication; 2004.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 - 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
 - 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
 - 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
 - 4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
 - 5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
 - 1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
 - 2. Conduit Clamps: Bolted type unless otherwise indicated.
- C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
- D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
 - 1. Comply with MFMA-4.
- E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
- F. Anchors and Fasteners:
 - 1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

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PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- 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. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Equipment Support and Attachment:
 - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 - 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- H. Secure fasteners according to manufacturer's recommended torque settings.
- I. Remove temporary supports.

END OF SECTION

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SECTION 260533.13 CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Stainless steel rigid metal conduit (RMC).
- C. Aluminum rigid metal conduit (RMC).
- D. Galvanized steel intermediate metal conduit (IMC).
- E. Stainless steel intermediate metal conduit (IMC).
- F. PVC-coated galvanized steel rigid metal conduit (RMC).
- G. Flexible metal conduit (FMC).
- H. Liquidtight flexible metal conduit (LFMC).
- I. Galvanized steel electrical metallic tubing (EMT).
- J. Stainless steel electrical metallic tubing (EMT).
- K. Rigid polyvinyl chloride (PVC) conduit.
- L. Electrical nonmetallic tubing (ENT).
- M. Liquidtight flexible nonmetallic conduit (LFNC).

1.02 RELATED REQUIREMENTS

- A. Section 07 84 00 - Firestopping.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- D. Section 26 05 33.16 - Boxes for Electrical Systems.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
 - 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
 - 4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
 - 5. Notify Architect of 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 between termination points is complete.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

1.05 QUALITY ASSURANCE

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

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1.07 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.
- C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A); 2020.
- D. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2018.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- F. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.
- G. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit; 2004.
- H. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2017.
- I. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- J. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit; 2018.
- K. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.
- L. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.
- M. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- N. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
- O. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
- P. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel; Current Edition, Including All Revisions.
- Q. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.
- R. UL 514A - Metallic Outlet Boxes; 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 797A - Electrical Metallic Tubing - Aluminum and Stainless Steel; Current Edition, Including All Revisions.
- W. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.
- X. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.
- Y. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit; Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.
- C. Underground:
 - 1. Under Slab on Grade: Use rigid PVC conduit.
 - 2. Exterior, Direct-Buried: Use PVC-coated galvanized steel rigid metal conduit or rigid PVC conduit.

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3. Exterior, Embedded Within Concrete: Use PVC-coated galvanized steel rigid metal conduit or rigid PVC conduit.
- D. Concealed Within Masonry Walls: Use electrical metallic tubing (EMT).
- E. Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT).
- F. Interior, Damp or Wet Locations: Use electrical metallic tubing (EMT).
- G. Exposed, Interior, Not Subject to Physical Damage: Use electrical metallic tubing (EMT).
- H. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- I. Hazardous/Classified Locations: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit (RMC).
- J. Flexible Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit (FMC).
 1. Maximum Length: 6 feet.
- K. Flexible Connections to Vibrating Equipment:
 1. Dry Locations: Use flexible metal conduit (FMC).
 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
 3. Maximum Length: 6 feet unless otherwise indicated.

2.02 CONDUIT - GENERAL REQUIREMENTS

- A. Comply with NFPA 70.
- B. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling mandrel through them.
- C. Provide conduit, fittings, supports, and accessories required for complete raceway system.
- D. Provide products listed, classified, and labeled as suitable for purpose intended.
- E. Minimum Conduit Size, Unless Otherwise Indicated:
 1. Branch Circuits: 3/4-inch trade size.
 2. Branch Circuit Homeruns: 1/2 inch (16 mm) trade size.
 3. Control Circuits: 1/2-inch trade size.
 4. Flexible Connections to Luminaires: 3/8-inch trade size.
 5. Underground, Interior: 3/4-inch trade size.
 6. Underground, Exterior: 1-inch 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. Manufacturers:
 1. Allied Tube & Conduit: www.alliedeg.com/#sle.
 2. Republic Conduit: www.republic-conduit.com/#sle.
 3. Wheatland Tube, a Division of Zekelman Industries: www.wheatland.com/#sle.
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- C. Fittings:
 1. Manufacturers:
 - a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
 - b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
 2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
 3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
 4. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.

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5. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.04 STAINLESS STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC stainless steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6A.
- B. Fittings:
 1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6A.
 2. Material: Use stainless steel with corrosion resistance equivalent to conduit.
 3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.05 ALUMINUM RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 1. Allied Tube & Conduit: www.alliedeg.com/#sle.
 2. Republic Conduit: www.republic-conduit.com/#sle.
 3. Wheatland Tube, a Division of Zekelman Industries: www.wheatland.com/#sle.
- B. Description: NFPA 70, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.
- C. Fittings:
 1. Manufacturers:
 - a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
 - b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
 2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6A
 3. Material: Use aluminum.
 4. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.06 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

- A. Manufacturers:
 1. Allied Tube & Conduit: www.alliedeg.com/#sle.
 2. Republic Conduit: www.republic-conduit.com/#sle.
 3. Wheatland Tube, a Division of Zekelman Industries: www.wheatland.com/#sle.
- B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
- C. Fittings:
 1. Manufacturers:
 - a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
 - b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
 2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
 3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
 4. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.
 5. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.07 STAINLESS STEEL 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. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.

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2.08 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 - 1. Robroy Industries: www.robroy.com/#sle.
- B. 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.
- C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil, 0.040 inch.
- D. PVC-Coated Boxes and Fittings:
 - 1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
 - 2. Nonhazardous Locations: Use boxes and fittings listed and labeled as complying with UL 514A, UL 514B, or UL 6.
 - 3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
 - 4. Material: Use steel or malleable iron.
 - 5. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil, 0.040 inch.
- E. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil, 0.015 inch.

2.09 FLEXIBLE METAL CONDUIT (FMC)

- A. Manufacturers:
 - 1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
 - 2. Electri-Flex Company: www.electriflex.com/#sle.
 - 3. International Metal Hose: www.metalhose.com/#sle.
- B. 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.
- C. Fittings:
 - 1. Manufacturers:
 - a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
 - b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
 - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 3. Material: Use steel or malleable iron.

2.10 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Manufacturers:
 - 1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
 - 2. Electri-Flex Company: www.electriflex.com/#sle.
 - 3. International Metal Hose: www.metalhose.com/#sle.
- B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- C. Fittings:
 - 1. Manufacturers:
 - a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
 - b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
 - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 3. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.

2.11 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers:
 - 1. Allied Tube & Conduit: www.alliedeg.com/#sle.
 - 2. Republic Conduit: www.republic-conduit.com/#sle.
 - 3. Wheatland Tube, a Division of Zekelman Industries: www.wheatland.com/#sle.
- B. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- C. Fittings:
 - 1. Manufacturers:

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- a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
- b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.
4. Connectors and Couplings: Use compression/gland or set-screw type.
 - a. Do not use indenter type connectors and couplings.
5. Damp or Wet Locations, Where Permitted: Use fittings listed for use in wet locations.

2.12 STAINLESS STEEL ELECTRICAL METALLIC TUBING (EMT)

- A. Description: NFPA 70, Type EMT stainless steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797A.
- B. Fittings:
 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Connectors and Couplings: Use compression/gland or set-screw type.

2.13 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Manufacturers:
 1. Cantex Inc: www.cantexinc.com/#sle.
 2. JM Eagle: www.jmeagle.com/#sle.
- B. 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.
- C. 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.

2.14 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)

- A. Manufacturers:
 1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
 2. Electri-Flex Company: www.electriflex.com/#sle.
 3. International Metal Hose: www.metalhose.com/#sle.
- B. Description: NFPA 70, Type LFNC liquidtight flexible nonmetallic conduit listed and labeled as complying with UL 1660.
- C. Fittings:
 1. Manufacturer: Same as manufacturer of conduit to be connected.
 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; suitable for type of conduit to be connected.

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. Install conduit in accordance with NECA 1.
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102.
- E. Install intermediate metal conduit (IMC) in accordance with NECA 101.
- F. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by manufacturer.

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- G. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- H. Install liquidtight flexible nonmetallic conduit (LFNC) in accordance with NECA 111.
- I. Conduit Support:
 - 1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 26 05 29.
 - 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 conduit clamp to support single conduit from beam clamp or threaded rod.
 - 6. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
 - 7. Use of wire for support of conduits is not permitted.
- J. 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, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
 - 7. Secure joints and connections to provide mechanical strength and electrical continuity.
- K. 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 building from underground at first accessible point to prevent entry of moisture and gases.
 - 6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
 - 7. 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.
 - 8. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 07 84 00.
- L. 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 conduits are subject to earth movement by settlement or frost.
- M. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at accessible point near 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.
- N. Provide grounding and bonding; see Section 26 05 26.

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3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.
- D. Correct deficiencies and replace damaged or defective conduits.

3.04 PROTECTION

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

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SECTION 260533.16 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. Boxes and enclosures for integrated power, data, and audio/video.
- D. Boxes for hazardous (classified) locations.
- E. Floor boxes.
- F. Underground boxes/enclosures.

1.02 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 Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

1.04 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.05 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
- 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 (Reaffirmed 2020).
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. SCTE 77 - Specifications for Underground Enclosure Integrity; 2023.
- 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.

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- J. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.
- K. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.
- L. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

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 suitable concrete type boxes where flush-mounted in concrete.
 - 4. Use suitable masonry type boxes where flush-mounted in masonry walls.
 - 5. Use raised covers suitable for the type of wall construction and device configuration where required.
 - 6. Use shallow boxes where required by the type of wall construction.
 - 7. Do not use "through-wall" boxes designed for access from both sides of wall.
 - 8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
 - 9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
 - 10. 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.
 - 11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
 - 12. Minimum Box Size, Unless Otherwise Indicated:
 - a. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
 - 13. Wall Plates: Comply with Section 26 27 26.
 - 14. Manufacturers:
 - a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
 - b. Hubbell Incorporated; Bell Products: www.hubbell-rtb.com/#sle.
 - c. Hubbell Incorporated; RACO Products: www.hubbell-rtb.com/#sle.
 - d. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
 - 1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
 - 2. NEMA 250 Environment Type, Unless Otherwise Indicated:
 - 3. Junction and Pull Boxes Larger Than 100 cubic inches:
 - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
 - 4. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
 - b. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com/#sle.
 - c. Hubbell Incorporated; Wiegmann Products: www.hubbell-wiegmann.com/#sle.
- D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may be used.
 - 1. Manufacturers:
 - a. Hubbell Incorporated: www.hubbell.com/#sle.
- E. Boxes for Hazardous (Classified) Locations: Listed and labeled as complying with UL 1203 for the classification of the installed location.
 - 1. Manufacturers:

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- a. Appleton, a brand of Emerson Electric Co: www.emerson.com/#sle.
 - b. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
 - c. Hubbell Incorporated; Killark Products: www.hubbell-killark.com/#sle.
- F. Floor Boxes:
1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26 27 26; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
 2. Use sheet-steel or cast iron floor boxes within slab above grade.
 3. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
 4. Manufacturer: Same as manufacturer of floor box service fittings.
- G. Underground Boxes/Enclosures:
1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
 2. Size: As indicated on drawings.
 3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches.
 4. Applications:
 - a. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.
 5. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
 - a. Manufacturers:
 - 1) Hubbell Incorporated; Quazite Products: www.hubbellpowersystems.com/#sle.
 - 2) MacLean Highline: www.macleanhighline.com/#sle.
 - 3) Oldcastle Precast, Inc: www.oldcastleprecast.com/#sle.
 - b. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.
 - c. Product(s):
 - 1) MacLean Highline PHA Series: Straight wall, all-polymer concrete splice box/pull box; available Tier 8, Tier 15, and Tier 22 load ratings.
 - (a) 11 by 18 by 12 inches nominal; Model PHA111812 (stackable).
 - 2) MacLean Highline CHA Series: Fiberglass/polymer concrete splice box/pull box; available Tier 8 and Tier 15 load ratings.
 - (a) 11 by 18 by 12 inches nominal; Model CHA111812.
 - 3) MacLean Highline CVA Series: Fiberglass/polymer concrete splice vault; available Tier 8, Tier 15, and Tier 22 load ratings.
 - (a) 30 by 48 by 18 inches nominal; Model CVA304818.

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. Box Supports:
 1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 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.

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- E. Install boxes plumb and level.
- F. 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.
- G. Install boxes as required to preserve insulation integrity.
- H. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.
- I. Underground Boxes/Enclosures:
 - 1. Install enclosure on gravel base, minimum 6 inches deep.
 - 2. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.
- J. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- K. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
- L. Close unused box openings.
- M. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- N. Provide grounding and bonding in accordance with Section 26 05 26.

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

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SECTION 260533.23 SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface raceway systems.
- B. Wireways.
- C. Wall duct.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- C. Section 26 05 33.13 - Conduit for Electrical Systems.
- D. Section 26 05 33.16 - Boxes for Electrical Systems.
- E. Section 26 05 39 - Underfloor Raceways for Electrical Systems: Trench duct.
- F. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- G. Section 26 27 23 - Indoor Service Poles.
- H. Section 26 27 26 - Wiring Devices: Receptacles.
- I. Section 27 10 00 - Structured Cabling: Voice and data jacks.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- B. NEMA PRP 5 - Installation Guidelines for Surface Nonmetallic Raceway; 2021.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL 5 - Surface Metal Raceways and Fittings; Current Edition, Including All Revisions.
- E. UL 5A - Nonmetallic Surface Raceways and Fittings; Current Edition, Including All Revisions.
- F. UL 111 - Outline of Investigation for Multioutlet Assemblies; Current Edition, Including All Revisions.
- G. UL 870 - Wireways, Auxiliary Gutters, and Associated Fittings; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of raceways with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate rough-in locations of outlet boxes provided under Section 26 05 33.16 and conduit provided under Section 26 05 33.13 as required for installation of raceways provided under this section.
 - 3. Verify minimum sizes of raceways with the actual conductors and components to be installed.
 - 4. Wall Duct: Coordinate the work with other trades to provide walls suitable for installation of flush-mounted wall duct where indicated.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install raceways until final surface finishes and painting are complete.
 - 2. Do not begin installation of conductors and cables until installation of raceways is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

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- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including dimensions, knockout sizes and locations, materials, fabrication details, finishes, service condition requirements, and accessories.
 - 1. Surface Raceway Systems: Include information on fill capacities for conductors and cables.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 RACEWAY REQUIREMENTS

- A. Provide all components, fittings, supports, and accessories required for a complete raceway system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Do not use raceways for applications other than as permitted by NFPA 70 and product listing.

2.02 SURFACE RACEWAY SYSTEMS

- A. Manufacturers:
 - 1. Hubbell Incorporated: www.hubbell.com/#sle.
 - 2. MonoSystems, Inc: www.monosystems.com/#sle.
 - 3. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/#sle.
- B. Surface Metal Raceways: Listed and labeled as complying with UL 5.
- C. Surface Nonmetallic Raceways: Listed and labeled as complying with UL 5A.
- D. Multioutlet Assemblies: Listed and labeled as complying with UL 111.

2.03 WIREWAYS

- A. Manufacturers:
 - 1. Cooper B-Line, a division of Cooper Industries: www.cooperindustries.com/#sle.
 - 2. Enduro Composites: www.endurocomposites.com/#sle.
 - 3. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com/#sle.
 - 4. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
- B. Description: Lay-in wireways and wiring troughs with removable covers; listed and labeled as complying with UL 870.
- C. Wireway Type, Unless Otherwise Indicated:
- D. Where wireway size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.04 WALL DUCT

- A. Manufacturers:
 - 1. Dennis Filges Company, Inc: www.filgesco.com/#sle.
 - 2. Hubbell Incorporated: www.hubbell.com/#sle.
 - 3. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
 - 4. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/#sle.
- B. Description: Metal raceways specifically designed for enclosure of wiring to X-ray machines and similar medical equipment; listed and labeled as complying with UL 870.
- C. Material: Steel, unless otherwise indicated.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).

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- C. Install raceways plumb and level.
- D. Arrange wireways and associated raceway connections to comply with NFPA 70, including but not limited to requirements for deflected conductors and wireways used as pullboxes. Increase size of wireway where necessary.
- E. Secure and support raceways in accordance with Section 26 05 29 at intervals complying with NFPA 70 and manufacturer's requirements.
- F. Close unused raceway openings.
- G. Provide grounding and bonding in accordance with Section 26 05 26.

3.02 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.03 PROTECTION

- A. Protect installed raceways from subsequent construction operations.

END OF SECTION

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SECTION 260536 CABLE TRAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal cable tray systems:
 - 1. Metal ladder cable tray.
 - 2. Metal ventilated trough cable tray.
 - 3. Metal solid-bottom cable tray.
 - 4. Metal single rail/center spine cable tray.
 - 5. Metal channel cable tray.
 - 6. Metal wire mesh/basket cable tray.

1.02 RELATED REQUIREMENTS

- A. Section 07 84 00 - Firestopping.
- B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
- C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- D. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- E. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
- F. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- G. Section 27 10 00 - Structured Cabling.

1.03 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- C. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.
- D. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- F. NEMA VE 1 - Metal Cable Tray Systems; 2017.
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. NEMA VE 2 - Cable Tray Installation Guidelines; 2018.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the arrangement of cable tray with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others. Coordinate the work with other trades to avoid installation of obstructions within cable tray required clearances.
 - 2. Coordinate arrangement of cable tray with the dimensions and clearance requirements of the actual products to be installed.
 - 3. Coordinate the work with placement of supports, anchors, etc. required for mounting.
 - 4. Notify of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Preinstallation Meeting: Convene one week prior to commencing work of this section; require attendance of all affected installers. Review proposed routing, sequence of installation, and protection requirements for installed cable tray.

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- C. Sequencing:
 - 1. Do not begin installation of cables until installation of associated cable tray run is complete.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cable tray system components and accessories. Include dimensions, materials, fabrication details, finishes, and span/load ratings.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions and NEMA VE 2, except do not store cable tray outdoors without cover as permitted in NEMA VE 2.
- B. Handle products carefully to avoid damage to finish.

PART 2 PRODUCTS

2.01 CABLE TRAY SYSTEM - GENERAL REQUIREMENTS

- A. Provide new cable tray system consisting of all required components, fittings, supports, accessories, etc. as necessary for a complete system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Do not use cable tray for applications other than as permitted by NFPA 70 and product listing/classification.
- D. Provide cable tray system and associated components suitable for use at indicated span/load ratings under the service conditions at the installed location.
- E. Unless otherwise indicated, specified span/load ratings are based on safety factor of 1.5 and working load only (no additional concentrated static load), with ratings for metal cable tray systems in accordance with NEMA VE 1.
- F. Unless otherwise indicated, specified load/fill depths and inside widths are nominal values, with values for metal cable tray systems in accordance with NEMA VE 1 including applicable allowable tolerances.

2.02 METAL CABLE TRAY SYSTEMS

- A. Manufacturers:
 - 1. Metal Cable Tray System:
 - a. Cablofil, a brand of Legrand North America, Inc: www.legrand.us/#sle.
 - b. Chalfant Manufacturing Company: www.chalfant-obo.com/#sle.
 - c. Cope, a brand of Atkore International Inc: www.copecabletray.com/#sle.
 - d. Thomas & Betts Corporation: www.tnb.com/#sle.
- B. Comply with NEMA VE 1.
- C. Finishes:
 - 1. Zinc Electroplated Steel: Comply with ASTM B633.
 - 2. Mill-Galvanized Before Fabrication (Pre-Galvanized) Steel: Comply with ASTM A653/A653M, G90 coating.
 - 3. Hot-Dip Galvanized After Fabrication (H.D.G.A.F.) Steel: Comply with ASTM A123/A123M.
 - 4. Stainless Steel: Type 304 or Type 316.
- D. Metal Ladder Cable Tray:
 - 1. Material: Mill-galvanized before fabrication (pre-galvanized) steel.
 - 2. Load/Fill Depth: As indicated on drawings.
 - 3. Span/Load Rating: As indicated on drawings.
 - 4. Rung Spacing: 9 inches on center for straight lengths.
 - 5. Inside Width: As indicated on drawings.
 - 6. Inside Radius of Fittings: 12 inches.

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- E. Metal Ventilated Trough Cable Tray:
 - 1. Material: Mill-galvanized before fabrication (pre-galvanized) steel.
 - 2. Bottom Type: Vented corrugated.
 - 3. Load/Fill Depth: As indicated on drawings.
 - 4. Span/Load Rating: As indicated on drawings.
 - 5. Inside Width: As indicated on drawings.
 - 6. Inside Radius of Fittings: 12 inches.
- F. Metal Solid-Bottom Cable Tray:
 - 1. Material: Mill-galvanized before fabrication (pre-galvanized) steel.
 - 2. Bottom Type: Solid corrugated or flat.
 - 3. Load/Fill Depth: As indicated on drawings.
 - 4. Span/Load Rating: As indicated on drawings.
 - 5. Inside Width: As indicated on drawings.
 - 6. Inside Radius of Fittings: 12 inches.
- G. Metal Single Rail/Center Spine Cable Tray:
 - 1. Material: Mill-galvanized before fabrication (pre-galvanized) steel.
 - 2. Configuration: Center rail or wall mount as indicated.
 - 3. Number of Tiers: Single tier.
 - 4. Load/Fill Depth: As indicated on drawings.
 - 5. Span/Load Rating: As indicated on drawings.
 - 6. Rung Spacing: 9 inches on center for straight lengths.
 - 7. Inside Width: As indicated on drawings.
 - 8. Inside Radius of Fittings: 12 inches.
- H. Metal Channel Cable Tray:
 - 1. Material: Mill-galvanized before fabrication (pre-galvanized) steel.
 - 2. Bottom Type: Solid bottom.
 - 3. Tray Depth: 1-3/4 inches.
 - 4. Span/Load Rating: As indicated on drawings.
 - 5. Tray Width: 4 inches.
 - 6. Inside Radius of Fittings: 12 inches.
- I. Metal Wire Mesh/Basket Cable Tray:
 - 1. Material: Zinc electroplated steel or mill-galvanized before fabrication (pre-galvanized) steel.
 - 2. Tray Depth: As indicated on drawings.
 - 3. Span/Load Rating: As indicated on drawings.
 - 4. Mesh Spacing: 2 by 4 inches.
 - 5. Tray Width: As indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that work likely to damage cable tray system has been completed.
- B. Verify that field measurements are as indicated.
- C. Verify that the dimensions and span/load ratings of cable tray system components are consistent with the indicated requirements.
- D. Verify that mounting surfaces are ready to receive cable tray and associated supports.
- E. 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 cable tray in accordance with NECA 1 (general workmanship), and NEMA VE 2.
- C. Unless otherwise indicated, arrange cable tray to be parallel or perpendicular to building lines.
- D. Arrange cable tray to provide required clearances and maintain cable access.
- E. Install cable tray plumb and level, with sections aligned and with horizontal runs at the proper elevation.

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- F. Metal Wire Mesh/Basket Cable Tray: Field fabricate fittings in accordance with manufacturer's instructions, using only manufacturer-approved connectors classified for bonding.
 - 1. Inside Radius of Fittings: 12 inches.
- G. Hot-Dip Galvanized After Fabrication (H.D.G.A.F.) Steel Cable Tray: After cutting, drilling, or deburring, use approved zinc-rich paint to repair finish in accordance with ASTM A780/A780M.
- H. Cable Tray Movement Provisions:
 - 1. Provide suitable expansion fittings where cable tray is subject to movement, including but not limited to:
 - a. Where cable tray crosses structural joints intended for expansion.
 - b. Long straight cable tray runs in accordance with NEMA VE 2.
 - 2. Use expansion guides in lieu of hold-down clamps where prescribed in NEMA VE 2.
 - 3. Set gaps for expansion fittings in accordance with NEMA VE 2.
- I. Cable Provisions:
 - 1. Use suitable fixed barrier strips to maintain separation of cables as indicated and as required by NFPA 70.
 - 2. Use suitable drop-out fittings or bushings where cables exit cable tray as required to maintain minimum cable bending radius.
 - 3. Use suitable cable support fittings for long vertical cable tray runs with heavy cables.
- J. Provide end closures at unconnected ends of cable tray runs.
- K. Cable Tray Support:
 - 1. Use manufacturer's recommended hangers and supports, located in accordance with NEMA VE 2 and manufacturer's requirements, but not exceeding specified span unless otherwise approved by Engineer. Provide required support and attachment in accordance with Section 26 05 29, where not furnished by cable tray manufacturer.
 - 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- L. Grounding and Bonding Requirements, in Addition to Requirements of Section 26 05 26:
 - 1. Comply with grounding and bonding requirements of NEMA VE 2.
 - 2. Metal Cable Tray Systems: Use suitable bonding jumpers or classified connectors to provide electrical continuity.
 - 3. Provide suitable equipment grounding conductor in each cable tray, except where cable tray contains only multiconductor cables with integral equipment grounding conductors. Do not use metal cable tray system as sole equipment grounding conductor.
 - a. Equipment Grounding Conductor for Steel Cable Tray: Use bare or insulated copper conductor.
- M. Penetrations: Install firestopping to preserve fire resistance rating of building elements, using materials and methods specified in Section 07 84 00.
- N. Identification Requirements, in Addition to Those Specified in Section 26 05 53.
- O. Install cable tray covers where indicated and as follows:

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect cable tray system for damage and defects.
- C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- D. Correct deficiencies and replace damaged or defective cable tray system components.

3.04 ADJUSTING

- A. Adjust tightness of mechanical connections to manufacturer's recommended torque settings.

3.05 CLEANING

- A. Remove dirt and debris from cable tray.
- B. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

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3.06 PROTECTION

- A. Protect cable tray system from subsequent construction operations.

END OF SECTION

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SECTION 260548 VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vibration isolation requirements.
- B. Seismic control requirements.
 - 1. Includes requirements for seismic qualification of equipment not specified in this section.
- C. Vibration-isolated equipment support bases.
- D. Vibration isolators.
- E. Seismic restraint systems.

1.02 RELATED REQUIREMENTS

- A. Section 01 45 33 - Code-Required Special Inspections and Procedures.
- B. Section 03 30 00 - Cast-in-Place Concrete.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.

1.03 DEFINITIONS

- A. Electrical Component: Where referenced in this section in regards to seismic controls, applies to any portion of the electrical system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., conduit, cable tray).
- B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.04 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.
- C. 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; 2022.
- D. FEMA 413 - Installing Seismic Restraints for Electrical Equipment; 2004.
- E. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage; 2012.
- F. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. ICC-ES AC156 - Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components; 2010, with Editorial Revision (2020).
- H. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2008.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.

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3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 4. Seismic Controls:
 - a. Coordinate the arrangement of seismic restraints with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 - b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.
 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.
 2. Seismic Controls: Include seismic load capacities.
- D. Shop Drawings - Vibration Isolation Systems:
1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.
 2. Vibration-Isolated Equipment Support Bases: Include base weights, including concrete fill where applicable; indicate equipment mounting provisions.
- E. Shop Drawings - Seismic Controls:
1. Include dimensioned plan views and sections indicating proposed electrical component locations and distributed system routing, with locations and details of gravity supports and seismic restraints and associated attachments.
 2. Identify mounting conditions required for equipment seismic qualification.
 3. Identify anchor manufacturer, type, minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
 4. Indicate proposed arrangement of distributed system trapeze support groupings.
 5. Indicate proposed locations for distributed system flexible fittings and/or connections.
 6. Indicate locations of seismic separations where applicable.
- F. Seismic Design Data:
1. Compile information on project-specific characteristics of actual installed electrical components necessary for determining seismic design forces required to design appropriate seismic controls, including but not limited to the following.
 - a. Component operating weight and center of gravity.
 - b. Component elevation in the building in relation to the roof elevation (z/h).
 - c. Component importance factor (I_p).
 - d. For distributed systems, component materials and connection methods.
 - e. Component amplification factor (a_p) and component response modification factor (R_p), determined in accordance with ASCE 7 tables.
 - f. Applicability of overstrength factor (for certain anchorage in concrete and masonry).
 - g. _____.
 2. Include structural calculations, stamped or sealed by seismic controls designer, demonstrating suitability of seismic controls for seismic design forces.
- G. Certification for seismically qualified equipment; identify basis for certification.
- H. Evaluation Reports: For products specified as requiring evaluation and recognition by a qualified evaluation service, provide current evaluation reports.
- I. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and

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installation of product.

- J. Evidence of qualifications for seismic controls designer.
- K. Evidence of qualifications for manufacturer.
- L. Manufacturer's detailed field testing and inspection procedures.
- M. Field quality control test reports.

1.07 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with applicable building code.
- C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- D. Seismic Controls Designer Qualifications: Registered professional engineer licensed in the State in which the Project is located and with minimum five years experience designing seismic restraints for nonstructural components.
 - 1. Designer may be employed by the manufacturer of the seismic restraint products.
- E. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

- A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing electrical equipment and/or electrical connections to vibration-isolated equipment.
- B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:
- C. General Requirements:
 - 1. Select vibration isolators to provide required static deflection.
 - 2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
 - 3. Select seismic type vibration isolators to comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
 - 4. Select vibration isolators for outdoor equipment to comply with wind design requirements.
 - 5. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2-inch operating clearance beneath base unless otherwise indicated.
- D. Equipment Isolation:
 - 1. Transformers:
 - a. Specified vibration isolators are in addition to any factory-installed internal core and coil assembly vibration isolators unless otherwise indicated.
 - b. Floor-Mounted Transformers, Nonseismic Applications: Use resilient material isolator pads, resilient material isolator mounts, or open (unhoused) spring isolators.
 - c. Floor-Mounted Transformers, Seismic Applications: Use seismic type resilient material isolator mounts or seismic type restrained spring isolators.
 - d. Suspended Transformers, Nonseismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.
 - e. Suspended Transformers, Seismic Applications: Use seismic type resilient material isolator hangers, seismic type spring isolator hangers, or seismic type combination resilient material/spring isolator hangers.
 - f. Wall-Mounted Transformers, Nonseismic Applications: Use resilient material isolator mounts.
 - g. Wall-Mounted Transformers, Seismic Applications: Use seismic type resilient material isolator mounts.
 - h. Minimum Static Deflection:

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- 1) Transformers Mounted on Grade-Level Slabs: 0.25 inch deflection unless otherwise indicated.
 - 2) Transformers Mounted at Above-Grade Levels: 0.5 inch deflection unless otherwise indicated.
2. Engine Generators:
- a. Specified vibration isolators are in addition to any factory-installed internal vibration isolators between generator set and integral base unless otherwise indicated; obtain generator set manufacturer approval of applied vibration isolation.
 - b. Nonseismic Applications, Isolators Not Located Below Sub-Base Fuel Tank: Use housed spring isolators or restrained spring isolators.
 - c. Nonseismic Applications, Isolators Located Below Sub-Base Fuel Tank: Use restrained spring isolators.
 - d. Seismic Applications: Use seismic type restrained spring isolators.
 - e. Provide vibration-isolated concrete inertia bases where indicated.
 - f. Minimum Static Deflection:
 - 1) Generators Mounted on Grade-Level Slabs: 1 inch deflection unless otherwise indicated.
- E. Conduit Isolation:
1. Use flexible conduit or cable for electrical connections to vibration-isolated equipment, including equipment installed under other sections or by others.
 - a. Minimum Length: 3 feet unless otherwise indicated.
 2. Vibration Isolators:
 - a. Provide vibration isolators for conduit supports:
 - 1) Located within 50 feet of connected vibration-isolated equipment where flexible connection to equipment is not possible.
 - 2) For conduits over 2 inch trade size located below or within 50 feet of noise-sensitive areas indicated.
 - 3) _____.
 - b. Minimum Static Deflection:
 - 1) Remainder of Supports: 0.75 inch deflection unless otherwise indicated.
 - c. Suspended Conduits, Nonseismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.
 - d. Suspended Conduits, Seismic Applications: Use seismic type resilient material isolator hangers, seismic type spring isolator hangers, or seismic type combination resilient material/spring isolator hangers.
 - e. Use modular seal or approved resilient material where vibration-isolated conduits penetrate building elements (e.g., walls, floors) arranged to prevent vibration transmission to structure.

2.02 SEISMIC CONTROL REQUIREMENTS

- A. Design and provide electrical component restraints, supports, and attachments suitable for seismic loads determined in accordance with applicable codes, as well as gravity and operating loads and other structural design considerations of the installed location. Consider wind loads for outdoor electrical components.
- B. Seismic Design Criteria: As indicated on drawings.
- C. Component Importance Factor (Ip): Electrical components essential to life safety to be assigned a component importance factor (Ip) of 1.5 as indicated or as required. This includes but is not limited to:
 1. Electrical components required to function for life safety purposes after an earthquake.
 2. Electrical components that support or otherwise contain hazardous substances.
- D. Seismic Qualification of Equipment:
 1. Provide special certification for electrical equipment furnished under other sections and assigned a component importance factor (Ip) of 1.5, certifying that equipment will remain operable following a design level earthquake.
 2. Seismic qualification to be by shake table testing in accordance with recognized testing standard procedure, such as ICC-ES AC156, acceptable to authorities having jurisdiction.
 3. Notify Architect and obtain direction where mounting restrictions required by conditions of seismic certification conflict with specified requirements.
 4. Seismically qualified equipment to be furnished with factory-installed labels referencing certificate of compliance and associated mounting restrictions.

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- E. Premanufactured Modular Electrical Equipment: Where not otherwise seismically qualified, premanufactured modules 6 feet high and taller furnished under other sections to be designed in accordance with seismic provisions for nonbuilding structures.
- F. Seismic Restraints:
 - 1. Provide seismic restraints for electrical components except where exempt according to applicable codes and specified seismic design criteria, as approved by authorities having jurisdiction.
 - 2. Seismic Restraint Exemptions:
 - a. Exemptions for Seismic Design Category C:
 - 1) Electrical components where either of the following apply:
 - (a) The component importance factor (I_p) is 1.0 and the component is positively attached to the structure.
 - (b) The component weighs 20 pounds or less or, in the case of a distributed system, 5 pounds per foot or less.
 - b. Exemptions for Seismic Design Category D, E, and F:
 - 1) Discrete electrical components that are positively attached to the structure where either of the following apply:
 - (a) The component weighs 400 pounds or less, has a center of mass located 4 feet or less above the adjacent floor level, flexible connections are provided between the component and associated ductwork, piping, and conduit, and the component importance factor (I_p) is 1.0.
 - (b) The component weighs 20 pounds or less or, in the case of a distributed system, 5 pounds per foot or less.
 - c. Conduit, Cable Tray, and Raceway Exemptions, All Seismic Design Categories:
 - 1) Raceways with component importance factor (I_p) of 1.0 where flexible connections are provided between cable tray or raceway and associated components, where cable tray or raceway is positively attached to the structure, and where one of the following apply:
 - (a) Trapeze supported conduits, cable trays, or raceways with trapeze assemblies using 3/8 inch diameter rod hangers not exceeding 12 inches in length from support point connection to the supporting structure, and the total weight supported by any single trapeze is 100 pounds or less.
 - (b) Trapeze supported conduits, cable trays, or raceways with trapeze assemblies using 1/2 inch diameter rod hangers not exceeding 12 inches in length from support point connection to the supporting structure, and the total weight supported by any single trapeze is 200 pounds or less.
 - (c) Trapeze supported conduits, cable trays, or raceways with trapeze assemblies using 1/2 inch diameter rod hangers not exceeding 24 inches in length from support point connection to the supporting structure, and the total weight supported by any single trapeze is 100 pounds or less.
 - (d) Hanger supported conduits, cable trays, or raceways with individual rod hangers 3/8 inch or 1/2 inch in diameter not exceeding 12 inches in length from support point connection to the supporting structure, and the total weight supported by any single rod is 50 pounds or less.
 - 2) Conduits less than 2-1/2 inch trade size.
 - d. Lighting Exemptions, All Seismic Design Categories:
 - 1) Suspended luminaires where attachments are designed to accommodate 1.4 times the operating weight acting in both the vertical and horizontal directions and connections to structure allow for 360 degree range of motion in the horizontal plane; arrange to prevent impact between luminaires and the structure or other nonstructural components.
 - 2) Lay-in luminaires weighing less than 56 pounds secured to ceiling grid and provided with safety wires in accordance with ASTM E580/E580M.
 - 3. Comply with applicable general recommendations of the following, where not in conflict with applicable codes, seismic design criteria, or other specified requirements:
 - a. ASHRAE (HVACA).
 - b. FEMA 413.
 - c. FEMA E-74.
 - d. SMACNA (SRM).
 - 4. Seismic restraint capacities to be verified by a Nationally Recognized Testing Laboratory (NRTL) or certified by an independent third-party registered professional engineer acceptable to authorities having jurisdiction.

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5. Seismic Type Vibration Isolators:
 - a. Comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
6. External Seismic Snubber Assemblies:
 - a. Provide quantity and arrangement of external seismic snubber assemblies as required to restrain equipment in all directions (both lateral and vertical).
 - b. Do not use external seismic snubber assemblies that restrain equipment only in one or more lateral directions (but not vertical) except where uplift forces are zero or are addressed by other restraints.
7. Seismic Restraint Systems:
 - a. Except where otherwise restricted, use of either cable or rigid restraints is permitted.
 - b. Use only cable restraints to restrain vibration-isolated electrical components, including distributed systems.
 - c. Use only one restraint system type for a given electrical component or distributed system (e.g., conduit, cable tray) run; mixing of cable and rigid restraints on a given component/run is not permitted.
 - d. Size restraint elements, including anchorage, to resist seismic loads as necessary to restrain electrical component in all lateral directions; consider bracket geometry in anchor load calculations.
 - e. Use rod stiffener clips to attach bracing to hanger rods as required to prevent rod buckling from vertical (upward) compressive load introduced by cable or rigid restraints loaded in tension, in excess of downward tensile load due to supported electrical component weight.
 - f. Select hanger rods and associated anchorage as required to accommodate vertical (downward) tensile load introduced by rigid restraints loaded in compression, in addition to downward tensile load due to supported electrical component weight.
 - g. Clevis hangers may only be used for attachment of transverse restraints; do not use for attachment of longitudinal restraints.
 - h. Where seismic restraints are attached to clevis hangers, provide clevis bolt reinforcement accessory to prevent clevis hanger deformation.
 - i. Do not introduce lateral loads on open bar joist chords or the weak axis of beams, or loads in any direction at other than panel points unless approved by project Structural Engineer of Record.
 - j. Manufacturer's certified seismic restraint design may be submitted as an alternative to project-specific design and documentation, subject to approval of authorities having jurisdiction.
- G. Seismic Attachments:
 1. Attachments to be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity.
 2. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) or qualified evaluation service acceptable to authorities having jurisdiction for compliance with applicable building code, and qualified for seismic applications; concrete anchors to be qualified for installation in both cracked and uncracked concrete.
 3. Do not use power-actuated fasteners.
 4. Do not use friction clips (devices that rely on mechanically applied friction to resist loads). Beam clamps may be used for supporting sustained loads where provided with restraining straps.
 5. Comply with anchor minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
 6. Concrete Housekeeping Pads:
 - a. Increase size of pad as required to comply with anchor requirements.
 - b. Provide pad reinforcement and doweling to ensure integrity of pad and connection and to provide adequate load path from pad to supporting structure.
- H. Seismic Interactions:
 1. Include provisions to prevent seismic impact between electrical components and other structural or nonstructural components.
 2. Include provisions such that failure of a component, either essential or nonessential, does not cause the failure of an essential component.
- I. Seismic Relative Displacement Provisions:
 1. Use suitable fittings or flexible connections to accommodate:
 - a. Relative displacements at connections between components, including distributed systems (e.g., conduit, cable tray); do not exceed load limits for equipment utility connections.

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- b. Relative displacements between component supports attached to dissimilar parts of structure that may move differently during an earthquake.
 - c. Design displacements at seismic separations.
 - d. Anticipated drifts between floors.
- J. California Office of Statewide Health Planning and Development (OSHPD) Preapprovals:
- 1. Manufacturer's certifications of seismic design of supports for nonstructural components to have current approval under OSHPD Preapproval of Manufacturer's Certification (OPM) program.
 - 2. Special seismic certifications to have current approval under OSHPD Special Seismic Certification Preapproval (OSP) program.

2.03 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

- A. Manufacturers:
- 1. Vibration-Isolated Equipment Support Bases:
 - a. Kinetics Noise Control, Inc; _____: www.kineticsnoise.com/#sle.
 - b. Mason Industries; _____: www.mason-ind.com/#sle.
 - c. Vibration Eliminator Company, Inc; _____: www.veco-nyc.com/#sle.
 - d. _____.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.
 - 3. Source Limitations: Furnish vibration-isolated equipment support bases and associated components and accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.
- B. Vibration-Isolated Structural Steel Bases:
- 1. Description: Engineered structural steel frames with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.
 - 2. Products:
 - a. _____.
 - b. _____.
 - c. _____.
- C. Vibration-Isolated Concrete Inertia Bases:
- 1. Description: Concrete-filled engineered steel forms with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.
 - 2. Minimum Base Depth: 6 inches.
 - 3. Minimum Base Mass (Including Concrete): 1.5 times weight of supported equipment.
 - 4. Concrete Reinforcement: Welded or tied reinforcing bars running both ways in a single layer.
 - 5. Concrete: Filled on site with minimum 3000 psi concrete in accordance with Section 03 30 00.
 - 6. Products:
 - a. _____.
 - b. _____.
 - c. _____.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 VIBRATION ISOLATORS

- A. Manufacturers:
- 1. Vibration Isolators:
 - a. Kinetics Noise Control, Inc; _____: www.kineticsnoise.com/#sle.
 - b. Mason Industries; _____: www.mason-ind.com/#sle.
 - c. Vibration Eliminator Company, Inc; _____: www.veco-nyc.com/#sle.
 - d. _____.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.
 - 3. Source Limitations: Furnish vibration-isolators and associated accessories produced by a single manufacturer and obtained from a single supplier.
- B. General Requirements:
- 1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
 - 2. Spring Elements for Spring Isolators:
 - a. Color code or otherwise identify springs to indicate load capacity.
 - b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
 - c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.

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- d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
 - e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
 - f. Selected to function without undue stress or overloading.
3. Seismic Snubbing Elements for Seismic Isolators:
 - a. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
 - b. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.
- C. Vibration Isolators for Nonseismic Applications:
1. Resilient Material Isolator Pads:
 - a. Description: Single or multiple layer pads utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material.
 - b. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch thickness.
 - c. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.
 - d. Products:
 - 1) _____.
 - 2) _____.
 - 3) _____.
 - 4) Substitutions: See Section 01 60 00 - Product Requirements.
 2. Resilient Material Isolator Mounts, Nonseismic:
 - a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material; fail-safe type.
 - b. Products:
 - 1) _____.
 - 2) _____.
 - 3) _____.
 - 4) Substitutions: See Section 01 60 00 - Product Requirements.
 3. Open (Unhoused) Spring Isolators:
 - a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) without a housing.
 - b. Bottom Load Plate: Nonskid, molded, elastomeric isolator material or steel with nonskid elastomeric isolator pad with provisions for bolting to supporting structure as required.
 - c. Furnished with integral leveling device for positioning and securing supported equipment.
 - d. Products:
 - 1) _____.
 - 2) _____.
 - 3) _____.
 - 4) Substitutions: See Section 01 60 00 - Product Requirements.
 4. Housed Spring Isolators:
 - a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing.
 - b. Furnished with integral elastomeric snubbing elements, nonadjustable type, for limiting equipment movement and preventing metal-to-metal contact between housing elements.
 - c. Bottom Load Plate: Steel with nonskid, elastomeric isolator pad with provisions for bolting to supporting structure as required.
 - d. Furnished with integral leveling device for positioning and securing supported equipment.
 - e. Products:
 - 1) _____.
 - 2) _____.
 - 3) _____.
 - 4) Substitutions: See Section 01 60 00 - Product Requirements.
 5. Restrained Spring Isolators, Nonseismic:
 - a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop.
 - b. Bottom Load Plate: Steel with nonskid, elastomeric isolator pad with provisions for bolting to supporting structure as required.
 - c. Furnished with integral leveling device for positioning and securing supported equipment.

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- d. Provides constant free and operating height.
- e. Products:
 - 1) _____.
 - 2) _____.
 - 3) _____.
 - 4) Substitutions: See Section 01 60 00 - Product Requirements.
- 6. Resilient Material Isolator Hangers, Nonseismic:
 - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the lower hanger rod connection.
 - b. Products:
 - 1) _____.
 - 2) _____.
 - 3) _____.
 - 4) Substitutions: See Section 01 60 00 - Product Requirements.
- 7. Spring Isolator Hangers, Nonseismic:
 - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection.
 - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
 - c. Products:
- 8. Combination Resilient Material/Spring Isolator Hangers, Nonseismic:
 - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the upper hanger rod connection.
 - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
- D. Vibration Isolators for Seismic Applications:
 - 1. Resilient Material Isolator Mounts, Seismic:
 - a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) isolator material; specifically designed and rated for seismic applications with integral snubbing in all directions.
 - b. Products:
 - 1) Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Restrained Spring Isolators, Seismic:
 - a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) in series with elastomeric (e.g., neoprene, rubber) isolator material within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop; specifically designed and rated for seismic applications with integral snubbing in all directions.
 - b. Bottom Load Plate: Steel with provisions for bolting to supporting structure as required.
 - c. Furnished with integral leveling device for positioning and securing supported equipment.
 - d. Provides constant free and operating height.
 - 3. Resilient Material Isolator Hangers, Seismic:
 - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) isolator material for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
 - 4. Spring Isolator Hangers, Seismic:
 - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
 - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

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PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 CODE-REQUIRED SPECIAL INSPECTIONS

- A. Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner or Architect in accordance with Section 01 45 33 and statement of special inspections as required by applicable building code.
- B. Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.
 - 1. Continuous Special Inspections: Special Inspection Agency 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 Inspections: Special Inspection Agency 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.
- C. Prior to starting work, Contractor to submit written statement of responsibility to authorities having jurisdiction and to Owner acknowledging awareness of special requirements contained in the statement of special inspections.
- D. Special Inspection Agency services do not relieve Contractor from performing inspections and testing specified elsewhere.

3.03 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install products in accordance with applicable requirements of NECA 1 (general workmanship).
- C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- D. Secure fasteners according to manufacturer's recommended torque settings.
- E. Install flexible conduit and cable connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.
- F. Vibration Isolation Systems:
 - 1. Vibration-Isolated Equipment Support Bases:
 - a. Provide specified minimum clearance beneath base.
 - 2. Spring Isolators:
 - a. Position equipment at operating height; provide temporary blocking as required.
 - b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
 - c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
 - 3. Isolator Hangers:
 - a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
 - b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
 - 4. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
 - 5. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
 - 6. Adjust isolators to be free of isolation short circuits during normal operation.
 - 7. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.
- G. Seismic Controls:
 - 1. Provide specified snubbing element air gap; remove any factory-installed spacers, debris or other obstructions.

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2. Use only specified components, anchorage, and hardware evaluated by seismic design. Comply with conditions of seismic certification where applicable.
3. Where mounting hole diameter exceeds bolt diameter by more than 0.125 inch, use epoxy grout, elastomeric grommet, or welded washer to reduce clearance to 0.125 inch or less.
4. Equipment with Sheet Metal Housings:
 - a. Use Belleville washers to distribute stress over a larger surface area of the sheet metal connection interface as approved by manufacturer.
 - b. Attach additional steel as approved by manufacturer where required to transfer loads to structure.
 - c. Where mounting surface is irregular, do not shim housing; reinforce housing with additional steel as approved by manufacturer.
5. Concrete Housekeeping Pads:
 - a. Size in accordance with seismic design to meet anchor requirements.
 - b. Install pad reinforcement and doweling in accordance with seismic design to ensure integrity of pad and associated connection to slab.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect vibration isolation and/or seismic control components for damage and defects.
- C. Vibration Isolation Systems:
 1. Verify isolator static deflections.
 2. Verify required clearance beneath vibration-isolated equipment support bases.
 3. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.
- D. Seismic Controls:
 1. Verify snubbing element air gaps.
- E. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

END OF SECTION

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SECTION 260553 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 RELATED REQUIREMENTS

- A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
- B. Section 26 05 36 - Cable Trays for Electrical Systems: Additional identification requirements for cable tray systems.
- C. Section 26 23 00 - Low-Voltage Switchgear: Factory-installed mimic bus.
- D. Section 27 10 00 - Structured Cabling: Identification for communications cabling and devices.

1.03 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; 2023.
- 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; 2024.
- E. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.04 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.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.07 FIELD CONDITIONS

- A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

- A. Identification for Equipment:

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1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
 - a. Switchgear:
 - 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) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
 - b. Switchboards:
 - 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) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
 - c. 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) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
 - 5) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
 - d. Transformers:
 - 1) Identify kVA rating.
 - 2) Identify voltage and phase for primary and secondary.
 - e. Enclosed switches, circuit breakers, and motor controllers:
 - 1) Identify voltage and phase.
 - f. Enclosed Contactors:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - g. Centralized Emergency Lighting Inverters:
 - 1) Identify input and output voltage and phase.
 - h. Transfer Switches:
 - 1) Identify voltage and phase.
 - 2) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.
2. Service Equipment:
 - a. Use identification nameplate to identify each service disconnecting means.
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. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
 - a. Service equipment.
 - b. Industrial control panels.
 - c. Motor control centers.
 - d. Elevator control panels.
 - e. Industrial machinery.
5. 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

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- 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) Date label applied.

- B. Identification for Conductors and Cables:
 1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
 2. 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.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Nameplates:
 1. Manufacturers:
 - a. Brimar Industries, Inc: www.brimar.com/#sle.
 - b. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 - c. Seton Identification Products: www.seton.com/#sle.
 2. Materials:
 - a. Indoor Clean, Dry Locations: Use plastic nameplates.
 3. 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.
 4. 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.

2.03 WIRE AND CABLE MARKERS

- A. Manufacturers:
 1. Brady Corporation: www.bradyid.com/#sle.
 2. HellermannTyton: www.hellermanntyton.com/#sle.
 3. Panduit Corp: www.panduit.com/#sle.
- B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.
- C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
- D. Legend: Power source and circuit number or other designation indicated.
- E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
- F. Minimum Text Height: 1/8 inch.
- G. Color: Black text on white background unless otherwise indicated.

2.04 VOLTAGE MARKERS

- A. Manufacturers:
 1. Brady Corporation: www.bradyid.com/#sle.
 2. Brimar Industries, Inc: www.brimar.com/#sle.
 3. Seton Identification Products: www.seton.com/#sle.
- B. Minimum Size:
 1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
- C. Legend:
- D. Color: Black text on orange background unless otherwise indicated.

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2.05 WARNING SIGNS AND LABELS

- A. Manufacturers:
 - 1. Brimar Industries, Inc: www.brimar.com/#sle.
 - 2. Clarion Safety Systems, LLC: www.clarionsafety.com/#sle.
 - 3. Seton Identification Products: www.seton.com/#sle.
- B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- C. Warning Signs:
 - 1. Materials:
 - 2. Minimum Size: 7 by 10 inches unless otherwise indicated.
- D. 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. Conductors and Cables: Legible from the point of access.
- 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. Mark all handwritten text, where permitted, to be neat and legible.

END OF SECTION

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SECTION 260573 POWER SYSTEM STUDIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Short-circuit study.
- B. Protective device coordination study.
- C. Arc flash and shock risk assessment.
 - 1. Includes arc flash hazard warning labels.
- D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 53 - Identification for Electrical Systems: Additional requirements for arc flash hazard warning labels.
- B. Section 26 21 00 - Low-Voltage Electrical Service Entrance.
- C. Section 26 23 00 - Low-Voltage Switchgear.
- D. Section 26 24 13 - Switchboards.
- E. Section 26 24 16 - Panelboards.
- F. Section 26 24 19 - Motor-Control Centers.
- G. Section 26 25 13 - Low-Voltage Busways.
- H. Section 26 28 13 - Fuses.
- I. Section 26 28 16.13 - Enclosed Circuit Breakers.
- J. Section 26 28 16.16 - Enclosed Switches.

1.03 REFERENCE STANDARDS

- A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2023.
- B. IEEE 141 - IEEE Recommended Practice for Electric Power Distribution for Industrial Plants; 1993 (Reaffirmed 1999).
- C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems; 2001, with Errata (2003).
- D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis; 1997.
- E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems; 2006.
- F. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations; 2018, with Errata (2019).
- G. NEMA MG 1 - Motors and Generators; 2021.
- H. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
- I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Existing Installations: Coordinate with equipment manufacturer(s) to obtain data necessary for completion of studies.
 - 2. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

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- B. Sequencing:
 - 1. Submit study reports prior to or concurrent with product submittals.
 - 2. Do not order equipment until matching study reports and product submittals have both been evaluated by Architect.
 - 3. Verify naming convention for equipment identification prior to creation of final drawings, reports, and arc flash hazard warning labels (where applicable).
- C. Scheduling:
 - 1. Arrange access to existing facility for data collection with Owner.
 - 2. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Study preparer's qualifications.
- C. Field testing agency's qualifications.
- D. Study reports, stamped or sealed and signed by study preparer.
- E. Product Data: In addition to submittal requirements specified in other sections, include manufacturer's standard catalog pages and data sheets for equipment and protective devices indicating information relevant to studies.
 - 1. Include characteristic time-current trip curves for protective devices.
 - 2. Include impedance data for busway.
 - 3. Include impedance data for engine generators.
 - 4. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
 - 5. Include documentation of listed series ratings upon request.
 - 6. Identify modifications made in accordance with studies that:
 - a. Can be made at no additional cost to Owner.
 - b. As submitted will involve a change to the contract sum.
- F. Arc Flash Hazard Warning Label Samples: One of each type and legend specified.
- G. Site-specific arc flash hazard warning labels.
- H. Field quality control reports.
- I. Certification that field adjustable protective devices have been set in accordance with requirements of studies.
- J. Project Record Documents: Revise studies as required to reflect as-built conditions.
 - 1. Include hard copies with operation and maintenance data submittals.
 - 2. Include computer software files used to prepare studies with file name(s) cross-referenced to specific pieces of equipment and systems.

1.06 POWER SYSTEM STUDIES

- A. Scope of Studies:
 - 1. Perform analysis of new electrical distribution system as indicated on drawings.
 - 2. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
 - 3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.
 - a. Known Operating Modes:
 - 1) Utility as source.
 - 2) Generator as source.
- B. General Study Requirements:
 - 1. Comply with NFPA 70.
 - 2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.
- C. Data Collection:
 - 1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system

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- and associated input data for use in system modeling.
- a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
 - 1) Obtain up-to-date information from Utility Company.
 - 2) Utility Company: As indicated on drawings.
 - b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.
 - c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 1 code letter designation.
 - d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
 - e. Protective Devices:
 - 1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).
 - 2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).
 - f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
 - g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.
- D. Short-Circuit Study:
1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.
 2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:
 - a. Maximum utility fault currents.
 - b. Maximum motor contribution.
 - c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
 3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.
- E. Protective Device Coordination Study:
1. Comply with applicable portions of IEEE 242 and IEEE 399.
 2. Analyze alternate scenarios considering known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
 3. Analyze protective devices and associated settings for suitable margins between time-current curves to provide adequate protection for equipment and conductors while achieving full selective coordination.
- F. Arc Flash and Shock Risk Assessment:
1. Comply with NFPA 70E.
 2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.
 - a. Where reasonable, study preparer may assume a maximum clearing time of two seconds in accordance with IEEE 1584, provided that the conditions are such that a worker's egress from an arc flash event would not be inhibited.
 - b. For single-phase systems, study preparer to perform calculations assuming three-phase system in accordance with IEEE 1584 using single phase bolted fault current, yielding conservative results.
 3. For equipment with main devices mounted in separate compartmentalized sections, perform calculations on both the line and load side of the main device.
 4. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:
 - a. Maximum and minimum utility fault currents.
 - b. Maximum and minimum motor contribution.
 - c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
- G. Study Reports:
1. General Requirements:
 - a. Identify date of study and study preparer.
 - b. Identify study methodology and software product(s) used.

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- c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
 - d. Identify base used for per unit values.
 - e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
 - f. Include conclusions and recommendations.
2. Short-Circuit Study:
 - a. For each scenario, identify at each bus location:
 - 1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).
 - 2) Fault point X/R ratio.
 - 3) Associated equipment short circuit current ratings.
 - b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.
 3. Protective Device Coordination Study:
 - a. For each scenario, include time-current coordination curves plotted on log-log scale graphs.
 - b. For each graph include (where applicable):
 - 1) Partial single-line diagram identifying the portion of the system illustrated.
 - 2) Protective Devices: Time-current curves with applicable tolerance bands for each protective device in series back to the source, plotted up to the maximum available fault current at the associated bus.
 - 3) Conductors: Damage curves.
 - 4) Transformers: Inrush points and damage curves.
 - 5) Generators: Full load current, overload curves, decrement curves, and short circuit withstand points.
 - 6) Motors: Full load current, starting curves, and damage curves.
 - 7) Capacitors: Full load current and damage curves.
 - c. For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings.
 - 1) Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.
 - 2) Include ground fault pickup and delay.
 - 3) Include fuse ratings.
 - 4) Protective Relays: Include current/potential transformer ratios, tap, time dial, and instantaneous pickup.
 - d. Identify cases where either full selective coordination or adequate protection is not achieved, along with recommendations.
 4. Arc Flash and Shock Risk Assessment:
 - a. For the worst case for each scenario, identify at each bus location:
 - 1) Calculated incident energy and associated working distance.
 - 2) Calculated arc flash boundary.
 - 3) Bolted fault current.
 - 4) Arcing fault current.
 - 5) Clearing time.
 - 6) Arc gap distance.
 - b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.
 - c. Include recommendations for reducing the incident energy at locations where the calculated maximum incident energy exceeds 8 calories per sq cm.

1.07 QUALITY ASSURANCE

- A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum five years experience in preparation of studies of similar type and complexity using specified computer software.
 1. Study preparer may be employed by manufacturer of electrical distribution equipment.
 2. Study preparer may be employed by field testing agency.
- B. Field Testing Agency Qualifications: Independent testing organization specializing in testing, analysis, and maintenance of electrical systems with minimum five years experience; NETA Accredited Company.
 1. Field Supervisor: Certified electrical testing technician; NETA ETT Level III.
- C. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.

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1. Products:
 - a. EasyPower LLC: www.easypower.com/#sle.
 - b. ETAP/Operation Technology, Inc: www.etap.com/#sle.
 - c. Power Analytics Corporation: www.poweranalytics.com/#sle.
 - d. SKM Systems Analysis, Inc: www.skm.com/#sle.

PART 2 PRODUCTS

2.01 ARC FLASH HAZARD WARNING LABELS

- A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.
 1. Materials: Comply with Section 26 05 53.
 2. Minimum Size: 4 by 6 inches.
 3. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.
 - a. Include orange header that reads "WARNING" unless otherwise indicated.
 - b. Include the text "Arc Flash and Shock Hazard; Appropriate PPE Required" or approved equivalent.
 - c. Include the following information:
 - 1) Arc flash boundary.
 - 2) Available incident energy and corresponding working distance.
 - 3) Site-specific PPE (personnel protective equipment) requirements.
 - 4) Nominal system voltage.
 - 5) Limited approach boundary.
 - 6) Restricted approach boundary.
 - 7) Equipment identification.
 - 8) Study preparer, report reference, and date calculations were performed.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install arc flash warning labels in accordance with Section 26 05 53.

3.02 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Provide the services of field testing agency or equipment manufacturer's representative to perform inspection, testing, and adjusting.
- C. Inspect and test in accordance with NETA ATS, except Section 4.
- D. Adjust equipment and protective devices for compliance with studies and recommended settings.
- E. Notify Architect of any conflicts with or deviations from studies. Obtain direction before proceeding.
- F. Submit detailed reports indicating inspection and testing results, and final adjusted settings.

3.03 CLOSEOUT ACTIVITIES

- A. Training: Include as part of the base bid training for Owner's personnel on electrical safety pertaining to arc flash and shock hazards.
 1. Use site-specific arc flash and shock risk assessment report as training reference, supplemented with additional training materials as required.
 2. Location: At project site.

END OF SECTION

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SECTION 260583 WIRING CONNECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical connections to equipment.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
- B. Section 26 05 33.13 - Conduit for Electrical Systems.
- C. Section 26 05 33.16 - Boxes for Electrical Systems.
- D. Section 26 27 26 - Wiring Devices.
- E. Section 26 28 16.16 - Enclosed Switches.
- F. Section 26 29 13 - Enclosed Controllers.

1.03 REFERENCE STANDARDS

- A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).
- B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
 - 2. Determine connection locations and requirements.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide wiring device manufacturer's catalog information showing dimensions, configurations, and construction.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
 - 1. Colors: Comply with NEMA WD 1.
 - 2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
 - 3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.
- B. Disconnect Switches: As specified in Section 26 28 16.16 and in individual equipment sections.
- C. Wiring Devices: As specified in Section 26 27 26.
- D. Flexible Conduit: As specified in Section 26 05 33.13.
- E. Wire and Cable: As specified in Section 26 05 19.
- F. Boxes: As specified in Section 26 05 33.16.

2.02 EQUIPMENT CONNECTIONS

- 1. Electrical Connection: Flexible conduit.
- 2. Electrical Connection: Cord and plug (NEMA 6-20R).

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3. Provide field-installed disconnect switch.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Provide receptacle outlet to accommodate connection with attachment plug.
- E. Provide cord and cap where field-supplied attachment plug is required.
- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- H. Install terminal block jumpers to complete equipment wiring requirements.
- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION

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SECTION 260916 ELECTRIC CONTROLS AND RELAYS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pushbutton and selector switches.
- B. Control stations and panels.
- C. Relays and time-delay relays.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 33.16 - Boxes for Electrical Systems: Cabinets and terminal blocks.

1.03 REFERENCE STANDARDS

- A. NEMA ICS 1 - Industrial Control and Systems General Requirements; 2022.
- B. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).
- C. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (Reaffirmed 2016).
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

- A. Shop Drawings: Submit to NEMA ICS 1 indicating control panel layouts, wiring connections and diagrams, dimensions, support points.
- B. Product Data: Provide for each component showing electrical characteristics and connection requirements.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ABB/GE: www.geindustrial.com/#sle.
- B. Allen-Bradley/Rockwell Automation: ab.rockwellautomation.com/#sle.
- C. Eaton Corporation: www.eaton.com/#sle.

2.02 COMPONENTS

- A. Control Switches and Stations:
 - 1. Contacts: NEMA ICS 2, Form Z.
 - 2. Contact Ratings: NEMA ICS 2, A150.
- B. Magnetic Control Relays: NEMA ICS 2, Class A300.
 - 1. Contacts: NEMA ICS 2, Form Z.
 - 2. Contact Ratings: NEMA ICS 2, Class A150.
- C. Solid-State Relays: NEMA ICS 2.
 - 1. Contacts: NEMA ICS 2, Form Z.
 - 2. Contact Ratings: NEMA ICS 2, Class A150.
- D. Clock Timers: NEMA ICS 2, Class A300, 24 hour timer.
 - 1. Astronomical dial.
 - 2. Contacts: NEMA ICS 2, Form Z.
 - 3. Contact Ratings: NEMA ICS 2, Class A150.

2.03 ENCLOSURES

- A. Control Station Enclosures: NEMA ICS 6; Type 1.
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- B. Relay Enclosures: NEMA ICS 6; Type 1.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install individual relays and time-delay relays in enclosures.
- C. Make electrical wiring interconnections as indicated.

END OF SECTION

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SECTION 260917 PROGRAMMABLE CONTROLLERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Programmable controllers.
- B. Remote input/output units.
- C. Programmer/loader unit.

1.02 REFERENCE STANDARDS

- A. NEMA ICS 1 - Industrial Control and Systems General Requirements; 2022.
- B. NEMA ICS 3 - Industrial Control and Systems: Medium Voltage Controllers Rated 2001 to 7200 Volts AC; 2005 (Reaffirmed 2010).
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate electrical characteristics and connection requirements, including layout of completed assemblies, interconnecting cabling, dimensions, weights, and external power requirements.
- C. Product Data: Provide data for each component specified showing electrical characteristics and connection requirements.

1.04 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store products in clean, dry area; maintain temperature to NEMA ICS 1.

PART 2 PRODUCTS

2.01 PROGRAMMABLE CONTROLLER

- A. Description: Programmable controller manufactured to NEMA ICS 3 Part 2.
- B. Configuration:
 - 1. Processor Unit: Include processor, power supply, random access memory and input/output modules.
 - 2. Remote Input/Output Unit: Include input/output modules , interface module and power supply for system inputs and outputs.
- C. Ratings:
 - 1. Input/Output Capacity: 40.
- D. Programming Instruction Set:
 - 1. Language Characteristics: Ladder diagram.
- E. Processor Unit:
 - 1. Memory Size: 2 KB.
- F. Input/Output Units:
- G. Power Supply: Input voltage of 120 volts, 60 Hz .
- H. Programmer/Loader Unit: Manual graphic display type.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

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- B. Do not install products until major construction is complete and building interior is enclosed and heated.
- C. Connect input and output devices as indicated.

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SECTION 260923 LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Occupancy sensors.
- B. Outdoor motion sensors.
- C. Time switches.
- D. In-wall time switches.
- E. Outdoor photo controls.
- F. Daylighting controls.
- G. Lighting contactors.
- H. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 25 36 26 - Integrated Automation Lighting Relays.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems
- D. Section 26 05 33.16 - Boxes for Electrical Systems.
- E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 26 09 18 - Remote Control Switching Devices: Remotely controlled devices for lighting control, including networked lighting controls, programmable relay panels, and remote control switching relays.
- G. Section 26 27 26 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.
- H. Section 26 28 13 - Fuses.
- I. Section 26 29 13 - Enclosed Controllers : General purpose contactors.
- J. Section 26 51 00 - Interior Lighting.
- K. Section 26 55 61 - Theatrical Lighting: Controls for stage lighting units.
- L. Section 26 56 00 - Exterior Lighting.

1.03 REFERENCE STANDARDS

- A. 47 CFR 15 - Radio Frequency Devices; current edition.
- B. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2023.
- C. ANSI C136.24 - American National Standard for Roadway and Area Lighting Equipment - Nonlocking (Button) Type Photocontrols; 2020.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- E. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.
- F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
- G. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).
- H. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (Reaffirmed 2016).
- I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 773 - Plug-in, Locking Type Photocontrols for Use with Area Lighting; Current Edition, Including All Revisions.

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- K. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.
- L. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.
- M. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.
- N. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.
- O. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules; Current Edition, Including All Revisions.
- P. 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 Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
 - 1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.
- C. Field Quality Control Reports.
- D. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Operation and Maintenance Data: Include detailed information on device programming and setup.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
- G. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

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 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for all occupancy sensors.
- C. Provide two year manufacturer warranty for all daylighting controls.

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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.

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.
- 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. 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. Sensitivity: Field adjustable.
 - 8. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
 - 9. Compatibility (Non-Dimming Sensors): Suitable for controlling 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.
 - 10. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on drawings.
 - 11. Where wired sensors are indicated, wireless sensors are acceptable provided that all components and wiring modifications necessary for proper operation are included.
 - 12. Wireless Sensors:
 - a. RF Range: 30 feet through typical construction materials.
 - b. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B application.
 - c. Power: Battery-operated with minimum ten-year battery life.
- 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. 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.
 - 2. Passive Infrared (PIR) Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.
 - 3. Ultrasonic Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 400 square feet.

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4. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.
- 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. Dimmer: 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, and listed as complying with UL 1472; type and rating suitable for load controlled.
 2. Passive Infrared (PIR) Wall Dimmer Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.
- E. Ceiling Mounted Occupancy Sensors:
1. All Ceiling Mounted Occupancy Sensors:
 - a. Description: Low profile occupancy sensors designed for ceiling installation.
 2. Passive Infrared (PIR) Ceiling Mounted Occupancy Sensors:
 - a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
 - b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
 3. Ultrasonic Ceiling Mounted Occupancy Sensors:
 - a. Standard Range Sensors: Capable of detecting motion within an area of 500 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
 - b. Medium Range Sensors: Capable of detecting motion within an area of 1,000 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
 - c. Extended Range Sensors: Capable of detecting motion within an area of 2,000 square feet at a mounting height of 9 feet.
 4. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
 - a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
 - b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
 5. Passive Infrared/Acoustic Dual Technology Ceiling Mounted Occupancy Sensors:
 - a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
 - b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet.
- F. Directional Occupancy Sensors:
1. All Directional Occupancy Sensors: Designed for wall or ceiling mounting, with integral swivel for field adjustment of motion detection coverage.
 - a. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
 2. Passive Infrared (PIR) Directional Occupancy Sensors:
 - a. Standard Range Sensors: Capable of detecting motion within a distance of 40 feet at a mounting height of 10 feet.
 - b. Long Range Sensors: Capable of detecting motion within a distance of 80 feet at a mounting height of 10 feet.
 - c. High Bay Sensors: Capable of detecting motion within a distance of 50 feet at a mounting height of 30 feet.
 3. Passive Infrared/Ultrasonic Dual Technology Directional Occupancy Sensors: Capable of detecting motion within a distance of 40 feet at a mounting height of 10 feet.
- G. Luminaire Mounted Occupancy Sensors: Designed for direct luminaire installation and control, suitable for use with specified luminaires.
- H. 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.

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- I. Power Packs for Wireless Occupancy Sensors:
 - 1. Description: Plenum rated, self-contained relay compatible with specified wireless occupancy sensors for switching of line voltage loads.
 - 2. Input Supply Voltage: Dual rated for 120/277 V ac.
 - 3. Load Rating: As required to control the load indicated on drawings.

2.03 OUTDOOR MOTION SENSORS

- A. Description: Factory-assembled wet location listed device suitable for wall or ceiling/eave mounting, with integral swivel for field adjustment of coverage, capable of detecting motion for automatic control of load indicated.
- B. Sensor Technology: Passive Infrared (PIR) designed to detect occupancy by sensing movement of thermal energy between zones.
- C. Operation: Unless otherwise indicated, motion sensor to turn load on when motion is detected and to turn load off when no motion is detected during an adjustable turn-off delay time interval.
- D. Turn-Off Delay: Field adjustable, with time delay settings available up to 15 minutes.
- E. Integral Photocell: For dusk to dawn operation.
- F. Manual Override: Activated by switching power off to unit and then back on.
- G. Load Rating: 1,000 W incandescent and fluorescent load at 120 V ac.
- H. Coverage: Capable of detecting motion within a distance of 50 feet at a mounting height of 8 feet, with a field of view of 270 degrees.

2.04 TIME SWITCHES

- A. Manufacturers:
 - 1. Intermatic, Inc: www.intermatic.com/#sle.
 - 2. Tork, a division of NSI Industries LLC: www.tork.com/#sle.
- 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:
 - 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. Input Supply Voltage: As indicated on the drawings.
 - 8. Provide lockable enclosure; environmental type per NEMA 250 as specified for the following installation locations:
- C. Electromechanical Time Switches:
 - 1. Description: Factory-assembled controller with motor-operated timing dial mechanism and adjustable trippers for setting on/off operations, listed and labeled as complying with UL 917.
 - 2. Program Capability:
 - a. Astronomic Time Switches: With same schedule for each day of the week and skip-a-day feature to omit selected days with automatic adjustment for seasonal changes in sunrise and sunset times.
 - 3. Schedule Capacity:
 - a. Astronomic Time Switches: Capable of turning load on at sunset and off at either sunrise or selected fixed time.
 - 4. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
 - 5. Input Supply Voltage: As indicated on the drawings.
 - 6. Provide lockable enclosure; environmental type per NEMA 250 as specified for the following installation locations:

2.05 OUTDOOR PHOTO CONTROLS

- A. 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.

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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.
- B. Locking Receptacle-Mounted Outdoor Photo Controls
1. Description: Plug-in locking type photo control unit complying with ANSI C136.10 for mounting on a compatible receptacle, listed and labeled as complying with UL 773.
 2. Housing: Weatherproof, impact resistant UV stabilized polypropylene, color to be selected.
 3. Photo Sensor: Cadmium sulfide.
 4. Light Level Activation: 1 to 3 footcandles turn-on and 1.5 to 1 turn-off to turn-on ratio with instant turn-on and delayed turn-off.
 5. Voltage: As required to control the load indicated on the drawings.
 6. Failure Mode: Fails to the on position.
 7. Load Rating: As required to control the load indicated on the drawings.
 8. Surge Protection: 160 joule metal oxide varistor.
- C. Button Type Outdoor Photo Controls
1. Description: Direct-wired photo control unit complying with ANSI C136.24 with weatherproof gasketed wall plate where required or indicated, listed and labeled as complying with UL 773A.
 2. Housing: Weather resistant polycarbonate.
 3. Photo Sensor: Cadmium sulfide.
 4. Light Level Activation: 1 to 3 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
 5. Voltage: As required to control the load indicated on the drawings.
 6. Failure Mode: Fails to the on position.
 7. Load Rating: As required to control the load indicated on the drawings.

2.06 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. 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:
 3. Where wired sensors are indicated, wireless sensors are acceptable provided that all components and wiring modifications necessary for proper operation are included.
 4. Wireless Daylighting Control Photo Sensors:
 - a. RF Range: 30 feet through typical construction materials.
 - b. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B application.
 - c. Power: Battery-operated with minimum ten-year battery life.
- C. Dimming Photo Sensors: Photo sensor units with integral controller compatible with specified dimming ballasts, for direct continuous dimming of up to 50 ballasts.
- D. Daylighting Control Switching Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors, for 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, load to be turned on when light level is below selected low set point and load to be turned off when light level is above selected high set point, with a no switching dead band between set points to prevent unwanted cycling.
 2. Input Delay: To prevent unwanted cycling due to intermittent light level fluctuations.
 3. Control Capability:
 - a. Multi-Zone Switching Modules: Capable of controlling up to three separately programmable channels.
- E. Daylighting Control Switching Modules for Wireless Sensors:
1. Description: Plenum rated, self-contained relay compatible with specified wireless photo sensors for switching of line voltage loads in response to changes in measured light levels according to selected

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- settings.
 - 2. Operation: Unless otherwise indicated, load to be turned on when light level is below selected low set point and load to be turned off when light level is above selected high set point, with a no switching dead band between set points to prevent unwanted cycling.
 - 3. Input Delay: To prevent unwanted cycling due to intermittent light level fluctuations.
 - 4. Control Capability: Capable of controlling one programmable channel.
 - 5. Input Supply Voltage: Dual rated for 120/277 V ac.
 - 6. Load Rating: As required to control the load indicated on drawings.
- F. Daylighting Control Dimming Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors and with specified dimming ballasts, for both continuous dimming of compatible dimming ballasts 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. Control Capability: Capable of controlling up to three separately programmable channels, with up to 50 ballasts per channel.
 - 3. Dimming and Fade Rates: Adjustable from 5 to 60 seconds.
 - 4. Cut-Off Delay: Selectable and adjustable from 0 to 20 minutes.
- G. Daylighting Control Dimming Modules for Wireless Sensors:
- 1. Description: Plenum rated control unit compatible with specified wireless photo sensors and with specified dimming ballasts, for continuous dimming of compatible dimming ballasts in response to changes in measured light levels according to selected settings.
 - 2. Operation: Unless otherwise indicated, specified load to be continuously brightened as not enough daylight becomes available and continuously dimmed as enough daylight becomes available.
 - 3. Load to be turned off when available daylight is sufficient to fully dim the load, after the selected time delay.
 - 4. Control Capability: Capable of controlling up to 32 ballasts with up to two separately programmable daylighting zones.
- H. Power Packs for Low Voltage Daylighting Control Modules:
- 1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage daylighting control modules for switching of line voltage loads. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
 - 2. Input Supply Voltage: Dual rated for 120/277 V ac.

2.07 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. Short Circuit Current Rating:
 - 1. Provide contactors with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- C. Enclosures:
 - 1. Comply with NEMA ICS 6.
 - 2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - 3. Finish: Manufacturer's standard unless otherwise indicated.

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.

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- 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 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 05 33.16 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 27 26.
- G. Provide required supports in accordance with Section 26 05 29.
- 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. Occupancy Sensor Locations:
 - 1. 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.
- J. 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.
- K. 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.
- L. Daylighting Control Photo Sensor Locations:
 - 1. 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.
 - 2. 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.
- M. Lamp Burn-In: Operate lamps at full output for minimum of 100 hours or prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - 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.

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- 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.

3.04 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 Architect.
- C. Adjust position of directional occupancy sensors and outdoor motion sensors to achieve optimal coverage as required.
- D. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.
- E. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Architect. Record settings in written report to be included with submittals.
- F. 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 Architect.
- G. 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 Architect.

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. See Section 01 79 00 - Demonstration and Training, for additional requirements.
- B. Demonstration: Demonstrate proper operation of lighting control devices to Architect, and correct deficiencies or make adjustments as directed.
- C. 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.

END OF SECTION

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SECTION 262200 LOW VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General purpose transformers.
- B. K-factor transformers rated for nonlinear loads.
- C. Buck-boost transformers.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- D. Section 26 05 33.13 - Conduit for Electrical Systems: Flexible conduit connections.
- E. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
- F. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- G. Section 26 09 16 - Electric Controls and Relays: Industrial control transformers.
- H. Section 26 24 16 - Panelboards.
- I. Section 26 27 13 - Electricity Metering: Instrument transformers for electrical metering.

1.03 REFERENCE STANDARDS

- A. 10 CFR 431, Subpart K - Energy Efficiency Program for Certain Commercial and Industrial Equipment - Distribution Transformers; Current Edition.
- B. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type Distribution and Power Transformers; 2015.
- C. IEEE C57.96 - IEEE Standard Guide for Loading Dry-Type Distribution and Power Transformers; 2013.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- E. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers; 2015.
- F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
- G. NEMA ST 20 - Dry Type Transformers for General Applications; 2021.
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 506 - Standard for Specialty Transformers; Current Edition, Including All Revisions.
- J. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers; Current Edition, Including All Revisions.

1.04 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 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 placement of supports, anchors, etc. required for mounting.
 - 4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

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1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.07 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 in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ABB/GE: www.geindustrial.com/#sle.
- B. Eaton Corporation: www.eaton.com/#sle.
- C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
- D. Siemens Industry, Inc: www.usa.siemens.com/#sle.

2.02 TRANSFORMERS - GENERAL REQUIREMENTS

- A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed, classified, and labeled as suitable for the purpose intended.
- B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:
 - 1. Altitude: Less than 3,300 feet.
 - 2. Ambient Temperature:
 - a. Greater than 10 kVA: Not exceeding 104 degrees F.
 - b. Less than 10 kVA: Not exceeding 77 degrees F.
- C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.
- D. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.
- E. Basic Impulse Level: 10 kV.
- F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.
- G. Isolate core and coil from enclosure using vibration-absorbing mounts.
- H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

2.03 GENERAL PURPOSE TRANSFORMERS

- A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.
- B. Insulation System and Allowable Average Winding Temperature Rise:
 - 1. Less than 15 kVA: Class 180 degrees C insulation system with 115 degrees C average winding temperature rise.
 - 2. 15 kVA and Larger: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.

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- C. Coil Conductors: Continuous aluminum windings with terminations brazed or welded.
- D. Winding Taps:
 - 1. Less than 3 kVA: None.
 - 2. 3 kVA through 15 kVA: Two 5 percent full capacity primary taps below rated voltage.
 - 3. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
 - 4. 500 kVA and Larger: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated voltage.
- E. Energy Efficiency: Comply with 10 CFR 431, Subpart K.
- F. Sound Levels: Standard sound levels complying with NEMA ST 20
- G. Mounting Provisions:
 - 1. Less than 15 kVA: Suitable for wall mounting.
 - 2. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.
 - 3. Larger than 75 kVA: Suitable for floor mounting.
- H. Transformer Enclosure: Comply with NEMA ST 20.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - 2. Construction: Steel.
 - a. Less than 15 kVA: Totally enclosed, non-ventilated.
 - b. 15 kVA and Larger: Ventilated.
 - 3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
 - 4. Provide lifting eyes or brackets.

2.04 K-FACTOR TRANSFORMERS RATED FOR NONLINEAR LOADS

- A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 1561, and designed to supply nonlinear loads to the degree designated by the UL defined K-factor; ratings as indicated on the drawings.
- B. K-factor Rating: K-4, or higher.
- C. Insulation System and Allowable Average Winding Temperature Rise: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.
- D. Coil Conductors: Continuous aluminum windings with terminations brazed or welded. Individually insulate secondary conductors and arrange to minimize hysteresis and eddy current losses at harmonic frequencies. Size secondary neutral conductor at twice the secondary phase conductor ampacity.
- E. Winding Taps: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
- F. Neutral Bus: Sized to accommodate twice the rated secondary current.
- G. Energy Efficiency: Comply with 10 CFR 431, Subpart K.
- H. Sound Levels: Standard sound levels complying with NEMA ST 20
- I. Mounting Provisions:
 - 1. Up to 75 kVA: Suitable for wall, floor, or trapeze mounting.
 - 2. Larger than 75 kVA: Suitable for floor mounting.
- J. Transformer Enclosure: Comply with NEMA ST 20.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - 2. Construction: Steel, ventilated.
 - 3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
 - 4. Provide lifting eyes or brackets.

2.05 BUCK-BOOST TRANSFORMERS

- A. Description: Self-cooled, four winding, buck-boost transformers listed and labeled as complying with UL 506 or UL 1561, and suitable for field connection as an autotransformer; ratings as indicated on the drawings.
- B. Insulation System and Allowable Average Winding Temperature Rise:

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1. Less than 0.25 kVA: Class 105 degree C insulation system with 55 degrees C rise.
 2. kVA and Larger: Class 180 degree C insulation system with 115 degree C rise.
- C. Coil Conductors: Continuous windings.
- D. Lugs: Suitable for terminating conductors sized for full rated load ampacity of transformer when operating in buck-boost configuration indicated.
- E. Mounting Provisions: Suitable for wall mounting.
- F. Transformer Enclosure: Comply with NEMA ST 20.
1. Environment Type per NEMA 250: Type 3R.
 2. Construction: Steel, totally enclosed, non-ventilated.
 3. Finish: Manufacturer's standard grey, suitable for outdoor installations.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.
- C. Perform pre-installation tests and inspections on transformers per manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.
- 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 transformers in accordance with NECA 409 and IEEE C57.94.
- D. Use flexible conduit, under the provisions of Section 26 05 33.13, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.
- E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.
- F. Install transformers plumb and level.
- G. Transformer Support:
1. Provide required support and attachment in accordance with Section 26 05 29, where not furnished by transformer manufacturer.
 2. Use integral transformer flanges, accessory brackets furnished by manufacturer, or field-fabricated supports to support wall-mounted transformers.
 3. Unless otherwise indicated, mount floor-mounted transformers on properly sized 3 inch high concrete pad constructed in accordance with Section 03 30 00.
 4. Use trapeze hangers assembled from threaded rods and metal channel (strut) to support suspended transformers. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- H. Provide grounding and bonding in accordance with Section 26 05 26.
- I. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.
- J. Where not factory-installed, install lugs sized as required for termination of conductors as indicated.

3.03 CLEANING

- A. Clean dirt and debris from transformer components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

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SECTION 262416 PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.
- C. Load centers.
- D. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- C. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
 - 1. Includes requirements for the seismic qualification of equipment specified in this section.
- D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 22 00 - Low-Voltage Transformers: Small power centers with integral primary breaker, transformer, and panelboard.
- F. Section 26 28 13 - Fuses: Fuses for fusible switches and spare fuse cabinets.
- G. Section 26 43 00 - Surge Protective Devices.

1.03 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; 2023.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2015.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
- E. NEMA PB 1 - Panelboards; 2011.
- F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 1000 Volts or Less; 2023.
- G. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- K. UL 67 - Panelboards; Current Edition, Including All Revisions.
- L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.
- M. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.
- N. UL 1699 - Arc-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.04 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.

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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 Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 30 00 - 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.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.07 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/#sle.
- C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
- D. Siemens Industry, Inc: www.usa.siemens.com/#sle.

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.
- 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.
- 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 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 250, and list and label as complying with UL 50 and UL 50E.
 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 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.
 4. Lockable Doors: All locks keyed alike unless otherwise indicated.

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- I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

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.
 - 2. Ground Bus Material: Aluminum.
- D. Circuit Breakers:
 - 1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.
- E. Enclosures:
 - 1. Provide surface-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.
 - 3. Ground Bus Material: Aluminum.
- 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 LOAD CENTERS

- A. Description: Circuit breaker type load centers listed and labeled as complying with UL 67; ratings, configurations, and features as indicated on the drawings.
- B. Bussing:
 - 1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
 - 2. Bus Material: Aluminum or copper.
- C. Circuit Breakers: Thermal magnetic plug-in type.
- D. Enclosures:
 - 1. Provide flush-mounted enclosures unless otherwise indicated.
 - 2. Provide circuit directory label on inside of door or individual circuit labels adjacent to circuit breakers.

2.06 OVERCURRENT PROTECTIVE DEVICES

- A. 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;

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- 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:
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 3. Conductor Terminations:
 - a. 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. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
 6. 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.

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 05 29.
- 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. 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.
- J. Provide grounding and bonding in accordance with Section 26 05 26.
- K. Install all field-installed branch devices, components, and accessories.
- L. Provide filler plates to cover unused spaces in panelboards.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than _____ amperes. Tests listed as optional are not required.
- D. Test GFCI circuit breakers to verify proper operation.

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- E. Test AFCI circuit breakers 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.

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

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SECTION 262713 ELECTRICITY METERING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Equipment for Owner electricity metering:

1.02 RELATED REQUIREMENTS

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- C. Section 26 05 33.16 - Boxes for Electrical Systems: Cabinets and enclosures for metering system components.
- D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 21 00 - Low-Voltage Electrical Service Entrance: Requirements for Utility Company electricity metering.
- F. Section 26 23 00 - Low-Voltage Switchgear: For interface with meters specified in this section.
- G. Section 26 24 13 - Switchboards: For interface with meters specified in this section.
- H. Section 26 24 16 - Panelboards: For interface with meters specified in this section.
- I. Section 26 28 13 - Fuses.

1.03 REFERENCE STANDARDS

- A. ANSI C12.1 - Electric Meters - Code for Electricity Metering; 2022.
- B. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2016.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
- E. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate work to provide equipment suitable for interface with electricity metering systems to be provided.
 - 2. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for electricity metering systems and associated components and accessories. Include ratings, configurations, standard wiring diagrams, dimensions, service condition requirements, and installed features.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.
- B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

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PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Electricity Meters:
 - 1. Veris Industries; E5x Series Enhanced Power and Energy Meter:
 - 2. Same as manufacturer of electrical distribution equipment used for this project.
 - a. ABB/GE: www.geindustrial.com/#sle.
 - b. Eaton Corporation: www.eaton.com/#sle.
 - c. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
 - d. Siemens Industry, Inc: www.usa.siemens.com/#sle.

2.02 EQUIPMENT FOR OWNER ELECTRICITY METERING

- A. Provide microprocessor-based digital electricity metering systems including all instrument transformers, wiring, and connections necessary for measurements specified.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Provide electricity metering systems and associated components compatible with the equipment and associated circuits to be metered.
- D. Service Conditions: Provide electricity meters suitable for operation under the service conditions at the installed location.
- E. Enclosures:
 - 1. Where not furnished by manufacturer, provide required cabinets and enclosures in accordance with Section 26 05 33.16.
 - 2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - 3. Finish: Manufacturer's standard unless otherwise indicated.
- F. Instrument Transformers:
 - 1. Comply with IEEE C57.13, where applicable.
 - 2. Select suitable ratio, burden, and accuracy as required for connected devices.
 - 3. Current Transformers: Compatible with connected meters; replace meters damaged by connection of incompatible current transformers. Provide shorting terminal blocks for connection of secondaries where applicable.
 - 4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of metering systems and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive meters.
- 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. Provide required support and attachment components in accordance with Section 26 05 29.
- D. Provide grounding and bonding in accordance with Section 26 05 26.
- E. Provide fuses complying with Section 26 28 13 as required.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.

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- D. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.
- E. Correct deficiencies and replace damaged or defective metering system components.

3.04 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 PROTECTION

- A. Protect installed system components from subsequent construction operations.

END OF SECTION

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SECTION 262723 INDOOR SERVICE POLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Utility columns.

1.02 REFERENCE STANDARDS

- A. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on materials, finishes, receptacle and connector configuration, and attachment details.

1.04 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hubbell Incorporated: www.hubbell.com/#sle.
- B. Panduit Corp: www.panduit.com/#sle.
- C. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/#sle.

2.02 UTILITY COLUMN COMPONENTS

- A. Main Body: Steel.
- B. Cover Plates: Steel.
- C. Convenience Receptacle Configuration: NEMA WD 6; Type 5-15. Furnish 4 per column.
- D. Telephone Connector: Modular, 4-position 4-conductor jack. Furnish 2 per column.
- E. Data Communications Connector: Modular, 8-position, 8-conductor jack. Furnish 1 per column.
- F. Foot: Suitable for carpet.
- G. Provide concealed top clamp to fasten pole to inverted "T" grid ceiling suspension member.

2.03 ACCESSORIES

- A. Trim plates for closing ceiling opening.
- B. Flexible cable assembly with connector for branch circuit connections.

2.04 FABRICATION

- A. Wire utility column with 12 AWG copper conductor to outlet box attached to top of pole. Allow 6 inch leads for connection to branch circuit.
- B. Provide full-sized opening at top of pole.
- C. Finish: Gray.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that installation of ceiling suspension system is complete.
- B. Verify that floor covering installation is complete.

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- C. Verify branch circuit wiring installation is completed, tested, in proper location, and ready for connection to indoor utility columns.
- D. Verify telephone raceway installation is completed, in proper location, and ready for connection to indoor utility columns.
- E. Verify data communication raceway installation is completed, in proper location, and ready for connection to indoor utility columns.

3.02 INSTALLATION

- A. Make wiring connections to branch circuit outlets using flexible conduit under provisions of Section 26 05 33.13.
- B. Bond equipment grounding conductor and body of pole to branch circuit equipment grounding conductor.
- C. Neatly cut openings in ceiling panels. Install trim plate.

END OF SECTION

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SECTION 262726 WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall switches.
- B. Wall dimmers.
- C. Fan speed controllers.
- D. Receptacles.
- E. Wall plates.
- F. Floor box service fittings.
- G. Poke-through assemblies.
- H. Access floor boxes.

1.02 RELATED REQUIREMENTS

- A. Section 09 69 00 - Access Flooring.
- B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.
- C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- D. Section 26 05 33.16 - Boxes for Electrical Systems.
- E. Section 26 05 33.23 - Surface Raceways for Electrical Systems: Surface raceway systems, including multioutlet assemblies.
- F. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- G. Section 26 05 83 - Wiring Connections: Cords and plugs for equipment.
- H. Section 26 09 23 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors, in-wall time switches, and in-wall interval timers.
- I. Section 26 27 23 - Indoor Service Poles.

1.03 REFERENCE STANDARDS

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h, with Amendments (2017).
- B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification); 2014g, with Amendment (2017).
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.
- E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).
- F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.
- 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 1310 - Class 2 Power Units; Current Edition, Including All Revisions.
- M. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.
- N. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.
- O. UL 1917 - Solid-State Fan Speed Controls; Current Edition, Including All Revisions.

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1.04 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 installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
 - 4. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
 - 5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.

PART 2 PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
- D. Provide tamper resistant receptacles for receptacles installed in dwelling units.
- E. Provide GFCI protection for receptacles installed within 6 feet of sinks.
- F. Provide GFCI protection for receptacles installed in kitchens.
- G. Provide GFCI protection for receptacles serving electric drinking fountains.
- H. Unless noted otherwise, do not use combination switch/receptacle devices.
- I. For flush floor service fittings, use tile rings for installations in tile floors.
- J. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

2.02 WIRING DEVICE FINISHES

- A. Provide wiring device finishes as described below unless otherwise indicated.
- B. Isolated Ground Convenience Receptacles: Orange.
- C. Wiring Devices Connected to Emergency Power: Red with red nylon wall plate.

2.03 WALL SWITCHES

- A. Manufacturers:
 - 1. Hubbell Incorporated: www.hubbell.com/#sle.
 - 2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
 - 3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.
- B. 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.

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- C. 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. Manufacturers:
 - 1. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
 - 2. Lutron Electronics Company, Inc: www.lutron.com/#sle.
 - 3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.
- B. 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.
- C. Control: Slide control type with separate on/off switch.

2.05 FAN SPEED CONTROLLERS

- A. Manufacturers:
 - 1. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
 - 2. Lutron Electronics Company, Inc: www.lutron.com/#sle.
 - 3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.
- B. Description: 120 V AC, solid-state, full-range variable speed, slide control type with separate on/off switch, with integral radio frequency interference filtering, fan noise elimination circuitry, power failure preset memory, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1917.
 - 1. Current Rating: 1.5 A unless otherwise indicated or required to control the load indicated on the drawings.

2.06 RECEPTACLES

- A. Manufacturers:
 - 1. Hubbell Incorporated: www.hubbell.com/#sle.
 - 2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
 - 3. Lutron Electronics Company, Inc: www.lutron.com/#sle.
 - 4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.
- B. 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.
- C. Convenience Receptacles:
 - 1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
 - 2. Isolated Ground Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, with ground contacts isolated from mounting strap; isolated ground triangle mark on device face; single or duplex as indicated on the drawings.
 - 3. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
 - 4. 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.
- D. 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. 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.
 - 3. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.

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- E. USB Charging Devices:
 - 1. USB Charging Devices - General Requirements: Listed as complying with UL 1310.

2.07 WALL PLATES

- A. Manufacturers:
 - 1. Hubbell Incorporated: www.hubbell-wiring.com/#sle.
 - 2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
 - 3. Lutron Electronics Company, Inc: www.lutron.com/#sle.
 - 4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.
- B. 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.
- C. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.
- D. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.
- E. 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.

2.08 FLOOR BOX SERVICE FITTINGS

- A. Manufacturers:
 - 1. Hubbell Incorporated: www.hubbell.com/#sle.
 - 2. Thomas & Betts Corporation: www.tnb.com/#sle.
 - 3. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/#sle.
- B. Description: Service fittings compatible with floor boxes provided under Section 26 05 33.16 with components, adapters, and trims required for complete installation.

2.09 POKE-THROUGH ASSEMBLIES

- A. Manufacturers:
 - 1. Hubbell Incorporated: www.hubbell.com/#sle.
 - 2. Thomas & Betts Corporation: www.tnb.com/#sle.
 - 3. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/#sle.
- B. Description: Assembly comprising floor service fitting, poke-through component, fire stops and smoke barriers, and junction box for conduit termination; fire rating listed to match fire rating of floor and suitable for floor thickness where installed.

2.10 ACCESS FLOOR BOXES

- A. Manufacturers - Access Floor Boxes:
 - 1. Hubbell Incorporated: www.hubbell-wiring.com/#sle.
 - 2. Thomas & Betts Corporation: www.tnb.com/#sle.
 - 3. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/#sle.
- B. Description: Metallic multi-service box suitable for mounting in access floor system.
- C. Configuration:

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.

Mesa County Justice Center 2nd Floor
Renovation

125 N. Spruce Street
Grand Junction, CO 81501

For Construction
08/30/2024

WIRING DEVICES
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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 05 33.16 as required for installation of wiring devices provided under this section.
- 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. For isolated ground receptacles, connect wiring device grounding terminal only to identified branch circuit isolated equipment grounding conductor. Do not connect grounding terminal to outlet box or normal branch circuit equipment grounding conductor.
- 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 top and horizontally mounted receptacles with grounding pole on left.
- 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. Install poke-through closure plugs in each unused core holes to maintain fire rating of floor.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - 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.

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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

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SECTION 262813 FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fuses.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- B. Section 26 24 13 - Switchboards: Fusible switches.
- C. Section 26 24 16 - Panelboards: Fusible switches.
- D. Section 26 28 16.16 - Enclosed Switches: Fusible switches.
- E. Section 26 31 00 - Photovoltaic Collectors: Additional requirements for photovoltaic fuses.

1.03 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 248-8 - Low-Voltage Fuses - Part 8: Class J Fuses; Current Edition, Including All Revisions.
- E. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses; Current Edition, Including All Revisions.
- F. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.
- G. UL 248-15 - Low-Voltage Fuses - Part 15: Class T Fuses; Current Edition, Including All Revisions.

1.04 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 Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 30 00 - 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.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Bussmann, a division of Eaton Corporation: www.cooperindustries.com/#sle.
- B. Littelfuse, Inc: www.littelfuse.com/#sle.
- C. Mersen: ep-us.mersen.com/#sle.

2.02 APPLICATIONS

- A. Service Entrance:
 - 1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
 - 2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.

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- B. Feeders:
 - 1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
 - 2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.
- C. General Purpose Branch Circuits: Class RK1, time-delay.
- D. Individual Motor Branch Circuits: Class RK1, time-delay.

2.03 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, Fast-Acting, Non-Time-Delay Fuses:
 - 2. Class RK5, Time-Delay Fuses:
 - 3. Class RK5, Fast-Acting, Non-Time-Delay Fuses:
- H. Class J Fuses: Comply with UL 248-8.
 - 1. Class J, Fast-Acting, Non-Time-Delay Fuses:
- I. Class L Fuses: Comply with UL 248-10.
- J. Class T Fuses: Comply with UL 248-15.

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

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SECTION 262816.13 ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Enclosed circuit breakers.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 05 73 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

1.03 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; 2023.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
- D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
- E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- H. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within 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 Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for circuit breakers, enclosures, and other installed components and accessories.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.07 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.

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- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed circuit breaker internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ABB/GE: www.geindustrial.com/#sle.
- B. Eaton Corporation: www.eaton.com/#sle.
- C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
- D. Siemens Industry, Inc: www.usa.siemens.com/#sle.

2.02 ENCLOSED CIRCUIT BREAKERS

- A. Description: Units consisting of molded case circuit breakers individually mounted in enclosures.
- 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 23 degrees F and 104 degrees F.
- D. Short Circuit Current Rating:
 - 1. Provide enclosed circuit breakers with listed short circuit current rating not less than the available fault current at the installed location indicated on the drawings.
- E. Conductor Terminations: Suitable for use with the conductors to be installed.
- F. Provide solidly bonded equipment ground bus in each enclosed circuit breaker, with a suitable lug for terminating each equipment grounding conductor.
- G. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
- H. Provide externally operable handle with means for locking in the OFF position.

2.03 MOLDED CASE CIRCUIT BREAKERS

- A. 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.
- B. Interrupting Capacity:
 - 1. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
 - 2. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
- C. Conductor Terminations:
 - 1. Provide mechanical lugs unless otherwise indicated.
 - 2. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
- D. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings of the enclosed circuit breakers are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed circuit breakers.
- D. Verify that conditions are satisfactory for installation prior to starting work.

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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 05 29.
- E. Install enclosed circuit breakers plumb.
- F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed circuit breakers 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 05 26.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with manufacturer's instructions and NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for circuit breakers used for service entrance and for circuit breakers larger than 800 amperes. Tests listed as optional are not required.
- D. Correct deficiencies and replace damaged or defective enclosed circuit breakers.

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 circuit breaker enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

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SECTION 262816.16 ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 28 13 - Fuses.
- E. Section 26 36 00 - Transfer Switches: Automatic and non-automatic switches listed for use as transfer switch equipment.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
- C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.
- D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
- E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

1.04 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 Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 30 00 - 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.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.07 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.

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- 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/#sle.
- C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
- D. Siemens Industry, Inc: www.usa.siemens.com/#sle.

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. Provide with switch blade contact position that is visible when the cover is open.
- H. Conductor Terminations: Suitable for use with the conductors to be installed.
- I. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
- J. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
- K. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- L. Heavy Duty Switches:
 - 1. Comply with NEMA KS 1.
 - 2. Conductor Terminations:
 - a. 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.

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).

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- 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 05 29.
- 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 05 26.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - 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 7.5.1.1.
- D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

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

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SECTION 262913 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. General purpose contactors.
 - 3. Manual motor starters.
- B. Overcurrent protective devices for motor controllers, including overload relays.
- C. Control accessories:
 - 1. Auxiliary contacts.
 - 2. Pilot devices.
 - 3. Control and timing relays.
 - 4. Control power transformers.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 24 19 - Motor-Control Centers.
- E. Section 26 28 13 - Fuses: Fuses for fusible switches.

1.03 REFERENCE STANDARDS

- A. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2016.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
- D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).
- E. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices; 2017.
- F. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (Reaffirmed 2016).
- G. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.
- H. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
- I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 98 - Enclosed and Dead-Front Switches; 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 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules; Current Edition, Including All Revisions.
- M. 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 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.
 - 2. Coordinate the work to provide motor controllers and associated overload relays suitable for use with the actual motors to be installed.

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3. Coordinate the work to provide controllers and associated wiring suitable for interface with control devices to be installed.
4. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
5. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
6. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 30 00 - 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.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.07 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/#sle.
- C. Rockwell Automation, Inc; Allen-Bradley Products: ab.rockwellautomation.com/#sle.
- D. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
- E. Siemens Industry, Inc: www.usa.siemens.com/#sle.

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. Short Circuit Current Rating:
 1. Provide controllers with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- F. Conductor Terminations: Suitable for use with the conductors to be installed.
- G. Enclosures:
 1. Comply with NEMA ICS 6.
 2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

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3. Finish: Manufacturer's standard unless otherwise indicated.
- H. 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.
- I. 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. 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.
 4. Overload Relays: Bimetallic thermal type unless otherwise indicated.
- J. General Purpose Contactors: Combination type unless otherwise indicated.
1. Combination Contactors: NEMA ICS 2, Class A combination controllers with magnetic contactor(s) and externally operable disconnect, but without integral overload relay(s).
 2. Configuration: Full-voltage non-reversing unless otherwise indicated.
 3. Disconnects: Circuit breaker type.
 - a. Circuit Breakers: Thermal magnetic 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.
- K. 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.

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.
- B. Fusible Disconnect Switches:
1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1, 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):

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- 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.
3. Molded Case Circuit Breakers:
 - a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489; ratings, configurations, and features as indicated on the drawings.

2.04 CONTROL ACCESSORIES

- A. Auxiliary Contacts:
 1. Comply with NEMA ICS 5.
 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 ICS 5; 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; number of switch positions as indicated or as required.
 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 ICS 5.
 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, plus _____ VA spare capacity.
 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 05 29.
- E. Install enclosed controllers plumb and level.
- F. Provide grounding and bonding in accordance with Section 26 05 26.
- G. Install all field-installed devices, components, and accessories.
- H. Provide fuses complying with Section 26 28 13 for fusible switches as indicated.

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- 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 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Motor Starters: Perform inspections and tests listed in NETA ATS, Section 7.16.1.1. Tests listed as optional are not required.
- D. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- E. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for circuit breakers larger than _____ amperes. Tests listed as optional are not required.
- F. Correct deficiencies and replace damaged or defective enclosed controllers or associated components.

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 controller enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

3.06 PROTECTION

- A. Protect installed enclosed controllers from subsequent construction operations.

END OF SECTION

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SECTION 263353 STATIC UNINTERRUPTIBLE POWER SUPPLY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Charger/rectifier units.
- B. Inverter units.
- C. Batteries.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 29 - Hangers and Supports for Electrical Systems.

1.03 REFERENCE STANDARDS

- A. IEEE 519 - IEEE Standard for Harmonic Control in Electric Power Systems; 2022.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
- C. NEMA PE 1 - Uninterruptible Power Systems (UPS) - Specification and Performance Verification; 2012 (Reaffirmed 2017).
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide catalog sheets and technical data sheets to indicate physical data and electrical performance, electrical characteristics, and connection requirements.
- 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, installation, and starting of product. Include equipment installation outline, connection diagram for external cabling, internal wiring diagram, and written instruction for installation.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect equipment from extreme temperature and humidity by storing in a conditioned space.
- B. Protect equipment from dust and debris by wrapping unit in dusttight cover and storing away from construction activity.

1.07 FIELD CONDITIONS

- A. Do not store or install unless temperature is maintained between 32 degrees F and 104 degrees F, at a relative humidity less than 95 percent (non-condensing).

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year warranty including coverage for batteries.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Uninterruptible Power Supply (UPS) System:

2.02 UNINTERRUPTIBLE POWER SUPPLY (UPS) SYSTEMS

- A. System Configuration: Non-redundant type with reverse transfer. Designed for capacity expansion by addition of parallel modules in field with minimum downtime.

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- B. Components:
- C. Design Standards: IEEE 519 and NEMA PE 1.

2.03 SYSTEM RATINGS AND OPERATING CHARACTERISTICS

- A. System Continuous Rating: As indicated on drawings, over entire battery voltage range at specified power factor. Maintain output voltage within specified limits at any load from full load to no-load.
- B. Battery Capacity: Capable of operating at full load for 3 hours.
- C. Voltage Rating: 120/208 volts, 1 phase.
- D. Input Voltage Operating Range: Plus or minus 10 percent.
- E. Input Frequency Operating Range: 60 Hz. Plus or minus 3 Hz.
- F. Input Current Limit: Adjustable to maximum of 125 percent of that required to operate at full load with battery bank on float charge.
- G. UPS Power Factor Over Full Range of Loads and Input Voltages: 74 to 100 percent, lagging.
- H. Harmonic Distortion of Input Current Wave Form: 5 percent maximum at full load.
- I. Output Free Running Frequency: 60 Hz Plus or minus 0.5 percent.
- J. Output Harmonic Distortion: Maximum 5 percent rms total harmonic distortion (THD) and maximum 3 percent any single harmonic, at rated frequency and voltage, from 10 percent load to full load and over battery voltage range, measured into a linear load.
- K. Phase Displacement:
 - 1. 120 plus or minus 1 degrees for balanced loads.
 - 2. 120 plus or minus 4 degrees for 50 percent unbalanced loads.
- L. Voltage Unbalance: 3 percent maximum line-line with 100 percent load unbalance.

2.04 DESIGN

- A. Inverter Type: Pulse-width modulated.
- B. Rectifier/Charger Capacity: Sufficient to supply full load to inverter while recharging fully-discharged battery to 95 percent of full capacity in four hours or less; and within the input current limits specified.
- C. Forced Air Cooled Unit: Provide with redundant cooling so that failure of any one cabinet cooling fan or fan circuit will not affect continued operation at full load and ambient temperature of 77 degrees F or lower.

2.05 FABRICATION

- A. Conversion Equipment Enclosure: NEMA 250, Type 1 enclosure allowing access from front for servicing adjustments and connections. Access through hinged door equipped with tumbler lock and latch handle. Equip cabinet for fork truck lifting.

2.06 BATTERY

- A. Storage Battery: Lead calcium heavy duty industrial battery, designed for auxiliary power service. Provide battery with impact resistant plastic case. Provide cells with explosion proof vents, clear containers, and ample space for plate growth without stressing container and cover.

2.07 CONTROLS AND INDICATORS

- A. Controls:
 - 1. AC input circuit breaker.
 - 2. Inverter operate switch to initiate inverter operation.
 - 3. Static switch transfer switch to permit manual actuation of static transfer switch.
 - 4. Static switch lock-out switch to inhibit automatic retransfer of load to inverter.
 - 5. Battery charge timer.
 - 6. Indicator test switch.
 - 7. Static switch preferred input circuit breaker
 - 8. Static switch output circuit breaker.
 - 9. Static switch bypass circuit breaker.
 - 10. Controls for maintenance bypass switch.

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- B. Indicators:
 - 1. Load connected to utility.
 - 2. Static transfer switch inhibited.
 - 3. High/low DC voltage.
 - 4. Overtemperature.
 - 5. Inverter output overload.
- C. Meters: Use 1 percent accuracy meters to indicate the following:
 - 1. Rectifier/charger DC voltage and current.
 - 2. Utility, inverter output, and load AC voltage.
 - 3. Load AC current.
 - 4. Inverter output and utility frequency.
 - 5. UPS output watts.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide required support and attachment in accordance with Section 26 05 29.

3.02 MAINTENANCE

- A. Provide service and maintenance of uninterruptible power supply for one year from Date of Substantial Completion.
- B. Include all costs, including labor, parts, and travel.

END OF SECTION

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SECTION 264300 SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surge protective devices for service entrance locations.
- B. Surge protective devices for distribution locations.
- C. Surge protective devices for branch panelboard locations.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 23 00 - Low-Voltage Switchgear.
- C. Section 26 24 13 - Switchboards.
- D. Section 26 24 16 - Panelboards.
- E. Section 26 24 19 - Motor-Control Centers.

1.03 ABBREVIATIONS AND ACRONYMS

- A. SPD: Surge Protective Device.

1.04 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to ordering equipment.

1.06 SUBMITTALS

- A. See Section 01 30 00 - 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.

1.07 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.08 DELIVERY, STORAGE, AND PROTECTION

- A. Store in a clean, dry space in accordance with manufacturer's written instructions.

1.09 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.10 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

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- B. Manufacturer's Warranty: Provide minimum five 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:
 - 1. ABB/GE: www.geindustrial.com/#sle.
 - 2. Current Technology; a brand of Thomas & Betts Power Solutions: www.tnbpowersolutions.com/#sle.
 - 3. Schneider Electric; Square D Brand SurgeLogic Products: www.surgeLogic.com/#sle.
 - 4. Surge Suppression, LLC (SSI): www.surgesuppression.com/#sle.
- B. Factory-installed, Internally Mounted Surge Protective Devices:
 - 1. Same as manufacturer of equipment containing surge protective device, to provide a complete listed assembly including SPD.

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 or factory-installed, internally-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:
- 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. 240/120V 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.
 - 3. 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.
 - 4. 480V Delta System Voltage: Not more than 1,800 V for L-G mode and 3,000 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 250: Unless otherwise indicated, as specified for the following installation locations:
 - 1. Indoor clean, dry locations: Type 1.
 - 2. Outdoor locations: Type 3R.
- H. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.
 - 1. Switchgear: See Section 26 23 00.
 - 2. Switchboards: See Section 26 24 13.
 - 3. Panelboards: See Section 26 24 16.
 - 4. Motor Control Centers: See Section 26 24 19.

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 system grounding and bonding is in accordance with Section 26 05 26, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.
- D. Verify that conditions are satisfactory for installation prior to starting work.

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3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- C. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 26 05 26 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.

3.04 CLEANING

- A. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

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SECTION 265100 INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior luminaires.aaaaaa
- B. Emergency lighting units.
- C. Exit signs.
- D. Ballasts and drivers.
- E. Lamps.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- B. Section 26 05 33.16 - Boxes for Electrical Systems.
- C. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
- D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 09 18 - Remote Control Switching Devices: Remote controls for lighting, including network lighting controls, programmable relay panels, and remote control switching relays.
- F. Section 26 27 26 - Wiring Devices: Manual wall switches and wall dimmers.
- G. Section 26 55 61 - Theatrical Lighting: Stage lighting units and associated controls.
- H. Section 26 56 00 - Exterior Lighting.

1.03 REFERENCE STANDARDS

- A. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2019.
- B. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- D. NECA 500 - Standard for Installing Indoor Lighting Systems; 2006.
- E. NECA 502 - Standard for Installing Industrial Lighting Systems; 2006.
- F. NECA/IESNA 500 - Standard for Installing Indoor Lighting Systems; 2006.
- G. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.
- K. UL 1598 - Luminaires; Current Edition, Including All Revisions.
- L. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.
- M. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.

1.04 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.

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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 Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 30 00 - 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.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.07 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.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide three year manufacturer warranty for LED luminaires, including drivers.

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, 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. 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.
- H. 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:

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- a. Listed.
- b. Designed for field cutting in accordance with listing.

2.03 EMERGENCY LIGHTING UNITS

- A. Manufacturers:
 1. Acuity Brands, Inc: www.acuitybrands.com/#sle.
 2. Cooper Lighting, a division of Cooper Industries: www.cooperindustries.com/#sle.
 3. Hubbell Lighting, Inc: www.hubbellighting.com/#sle.
- B. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
- C. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
- D. Battery:
 1. Size battery to supply all connected lamps, including emergency remote heads where indicated.
- E. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
- F. Provide low-voltage disconnect to prevent battery damage from deep discharge.

2.04 EXIT SIGNS

- A. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.
 1. Number of Faces: Single- or double-face as indicated or as required for installed location.
 2. Directional Arrows: As indicated or as required for installed location.

2.05 BALLASTS AND DRIVERS

- A. Ballasts/Drivers - General Requirements:
 1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
 2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
- 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. Control Compatibility: Fully compatible with the dimming controls to be installed.
 - a. Wall Dimmers: See Section 26 27 26.

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 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.
- B. Install products in accordance with manufacturer's instructions.
- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).
- D. Provide required support and attachment in accordance with Section 26 05 29.
- E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

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- 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.
 - 3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
- G. Suspended Luminaires:
 - 1. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
 - 2. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet between supports.
- H. Install accessories furnished with each luminaire.
- I. Bond products and metal accessories to branch circuit equipment grounding conductor.
- J. Emergency Lighting Units:
- K. 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.
- L. Install lamps in each luminaire.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - 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. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.
- E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.04 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.
- B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.
- C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.05 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.

3.06 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

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SECTION 265140 LUMINAIRES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Luminaires.
- B. LED drivers.
- C. Power interfaces.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 33.16 - Boxes for Electrical Systems.
- B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

- A. 47 CFR 15 - Radio Frequency Devices; current edition.
- B. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts; 2023.
- C. ANSI/ESD S20.20 - For the Development of an Electrostatic Discharge Control Program for – Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices); 2021.
- D. CSA C22.2 No. 223 - Power Supplies with Extra-Low-Voltage Class 2 Outputs; 2015 (Reaffirmed 2020).
- E. IEC 61000-4-2 - Electromagnetic Compatibility (EMC) - Part 4-2: Testing and Measurement Techniques - Electrostatic Discharge Immunity Test; 2008.
- F. IEEE 1789 - IEEE Recommended Practices for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers; 2015.
- G. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).
- H. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- I. NECA/IESNA 500 - Standard for Installing Indoor Lighting Systems; 2006.
- J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.
- M. UL 1310 - Class 2 Power Units; Current Edition, Including All Revisions.
- N. UL 1598 - Luminaires; Current Edition, Including All Revisions.
- O. UL 1598C - Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits; Current Edition, Including All Revisions.
- P. 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.
- Q. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.
- R. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices; 2020.
- S. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.

1.04 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

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- 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 work to provide ballasts/drivers compatible with the lighting controls to be installed.
- 4. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, and installed accessories; include model number nomenclature clearly marked with all proposed features.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Receive, handle, and store products according to NECA/IESNA 500 and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Ballasts/Drivers:
 - 1. Without Qualified Manufacturer System On-Site Start-Up: Three years 100 percent parts coverage, no manufacturer labor coverage.
 - 2. With Qualified Manufacturer System On-Site Start-Up: Five years 100 percent parts coverage, no manufacturer labor coverage.
- C. LED Luminaires: Five years 100 percent parts coverage, no manufacturer labor coverage.
- D. Fluorescent Luminaires:
 - 1. Without Qualified Manufacturer System On-Site Start-Up: Three years 100 percent parts coverage, no manufacturer labor coverage.
 - 2. With Qualified Manufacturer System On-Site Start-Up: Five years 100 percent parts coverage, no manufacturer labor coverage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Dimming Ballasts and Drivers:
 - 1. Where possible provide ballasts/drivers produced by a single manufacturer.
 - a. Manufacturer Limitations: Where possible, provide ballasts/drivers produced by a single manufacturer.

2.02 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.

2.03 LUMINAIRE GENERAL REQUIREMENTS

- 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 and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- 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

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- distribute the light.
- E. 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.
 - F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
 - G. 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.
 - H. Fluorescent Luminaires:
 - 1. Provide ballast disconnecting means complying with NFPA 70 where required.
 - I. LED Luminaire Components: UL 8750 recognized or listed as applicable.
 - J. Emergency Power Supply Units: Suitable for use with indicated luminaires, complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

2.04 LED DRIVERS

- A. General Requirements:
 - 1. Operate for at least 50,000 hours at maximum case temperature and 90 percent non-condensing relative humidity.
 - 2. Provide thermal protection by automatically reducing power output to protect LED driver and LED light engine/fixture from damage due to over-temperature conditions that exceed the LED driver's maximum operating temperature at the calibration point (tc).
 - 3. Provide integral recording of operating hours and maximum operating temperature to aid in troubleshooting and warranty claims.
 - 4. Designed and tested to withstand electrostatic discharges incurred during manufacturing, installation, or field troubleshooting without impairment of performance when tested according to IEC 61000-4-2.
 - 5. Manufactured in a facility that employs ESD reduction practices in compliance with ANSI/ESD S20.20.
 - 6. UL 8750 recognized or listed as applicable.
 - 7. UL Type TL rated or UL Class P listed where possible to allow for easier fixture evaluation and listing of different driver series.
 - 8. Suitable for field replacement as applicable; listed in accordance with UL 1598C or UL 8750, Class P as indicated.
 - 9. Designed and tested to withstand Category A surges of 4,000 V according to IEEE C62.41.2 without impairment of performance.
 - 10. Class A sound rating; inaudible in a 27 dBA ambient.
 - 11. Demonstrate no visible change in light output with a variation of plus or minus 10 percent change in line-voltage input.
 - 12. LED drivers of the same family/series to track evenly across multiple fixtures at all light levels.
 - 13. Offer programmable output currents in 10 mA or smaller increments within designed driver operating ranges for custom fixture length and lumen output configurations, while meeting a low-end dimming range of 100 to 0.1 percent, 100 to 1 percent or 100 to 5 percent as applicable.
 - 14. Meet NEMA 410 inrush requirements for mitigating inrush currents with solid state lighting sources.
 - 15. Employ integral fault protection up to 277 V to prevent LED driver damage or failure in the event of incorrect application of line-voltage to communication link inputs.
 - 16. LED driver may be remote located up to 100 feet from LED light engine depending on power outputs required and wire gauge utilized by installer.
- B. Digital Control :
 - 1. Employ power failure memory; LED driver to automatically return to the previous state/light level upon restoration of utility power.
 - 2. Operate from input voltage of 120 V through 277 V at 50/60 Hz.
 - 3. Automatically go to 100 percent light output upon loss of control link voltage and lock out system commands until digital control link voltage is restored. Manufacturer to offer UL 924 compliance.
 - 4. Each driver responds independently per system maximum:
 - a. Up to 32 occupant sensors.
 - b. Up to 16 daylight sensors.
 - 5. Responds to digital load shed command. (Example: If light output is at 30 percent and a load shed command of 10 percent is received, the driver automatically sets the maximum light output at 90

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- percent and lowers current light output by three percent to 27 percent).
6. Digital low-voltage control wiring capable of being wired as either Class 1 or Class 2.
- C. Product(s):
1. Digital Control, 0.1 Percent Dimming with Soft-On and Fade-to-Black Low End Performance;
 - a. Dimming Range: 100 to 0.1 percent measured output current.
 - b. Features smooth fade-to-on and fade-to-black low end dimming performance for an incandescent-like dimming experience.
 - c. Typically dissipates 0.25 W standby power at 120 V and 0.40 W standby power at 277 V.
 - d. Complies with FCC requirements of 47 CFR 15, for commercial applications at 120-277 V and residential applications at 120 V.
 - e. Total Harmonic Distortion (THD): Less than 20 percent at maximum power; complies with ANSI C82.11.
 - f. Class 2 output designed to withstand hot swap of LED loads; meets UL 1310 and CSA C22.2 No. 223.
 - g. Driver outputs to be short circuit protected, open circuit protected, and overload protected.
 - h. Constant Voltage Drivers:
 - 1) Support for cove and under-cabinet fixtures at 24 V.
 - (a) Support LED arrays from 2 W to 96 W.
 - (b) Pulse Width Modulation (PWM) dimming frequency meets IEEE 1789.
 - (c) Meets solid state requirements for power factor, transient protection, standby power consumption, start time, and operating frequency in Energy Star for Luminaires Version 2.0.
 - (d) UL listed.

2.05 POWER INTERFACES

- A. Provide power interfaces as indicated or as required to control the loads as indicated.
- B. General Requirements:
 1. Phase independent of control input.
 2. Rated for use in air-handling spaces as defined in UL 2043.
 3. Utilize air gap off to disconnect the load from line supply.
 4. Diagnostics and Service: Replacing power interface does not require re-programming of system or processor.
- C. Product(s):
 1. Phase-Adaptive Power Module: Provides interface for phase control input to provide full 16 A circuit output of forward/reverse phase control for compatible loads.
 2. Switching Power Module: Provides interface for phase control or switched input to provide full 16 A circuit output of switching for compatible non-dim loads.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- 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 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.
- B. Install products according to manufacturer's instructions.
- C. Perform work in a neat and workmanlike manner in accordance with NECA 1.
- D. Install luminaires in accordance with NECA/IESNA 500 (commercial lighting).
- E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- F. Suspended Ceiling Mounted Luminaires:

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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. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.
- G. 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.
- H. Suspended Luminaires:
1. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
 2. Install canopies tight to mounting surface.
- I. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
- J. Install accessories furnished with each luminaire.
- K. Bond products and metal accessories to branch circuit equipment grounding conductor.
- L. Install lamps in each luminaire.
- M. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

3.03 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

3.04 CLEANING

- A. Clean surfaces according to NECA/IESNA 500 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.05 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

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SECTION 271000 STRUCTURED CABLING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Communications system design requirements.
- B. Communications pathways.
- C. Communications grounding and bonding.
- D. Communications identification.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 05 36 - Cable Trays for Electrical Systems.
- C. Section 26 05 33.16 - Boxes for Electrical Systems.
- D. Section 26 05 53 - Identification for Electrical Systems: Identification products.
- E. Section 27 05 33.13 - Conduit for Communications Systems.

1.03 REFERENCE STANDARDS

- A. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition; 2019.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set; 2023.
- D. TIA-569 - Telecommunications Pathways and Spaces; 2019e, with Addendum (2022).
- E. TIA-606 - Administration Standard for Telecommunications Infrastructure; 2021d.
- F. TIA-607 - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2019d, with Addendum (2021).

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 Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
- C. Evidence of qualifications for installer.
- D. Field Test Reports.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: A company having at least 3 years experience in the installation and testing of the type of system specified, and:
 - 1. Employing a BICSI Registered Communications Distribution Designer (RCDD).
 - 2. Supervisors and installers factory certified by manufacturers of products to be installed.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.

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1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Keep stored products clean and dry.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a 2 year period after Date of Substantial Completion.

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. Provide fixed cables and pathways that comply with NFPA 70 and TIA-607 and are UL listed or third party independent testing laboratory certified.
 - 3. 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.
 - 4. 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: Copper, 4 -pair.
 - 3. Offices and Work Areas: Provide one voice outlet and one data outlet in each work area.
- 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.
- D. 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.
- E. 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 PATHWAYS

- A. Conduit: See section 27 05 33.13.
- B. Cable Trays: See Section 26 05 36.

2.03 GROUNDING AND BONDING COMPONENTS

- A. Comply with TIA-607.

2.04 IDENTIFICATION PRODUCTS

- A. Comply with TIA-606.

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), BICSI N1, 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.

3.02 INSTALLATION OF PATHWAYS

- A. Install pathways with the following minimum clearances:

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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.

B. Outlet Boxes:

1. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of telecommunications outlets provided under this section.
 - a. Mounting Heights: Unless otherwise indicated, as follows:
 - 1) Telephone and Data Outlets: 18 inches above finished floor.
 - 2) Telephone Outlets for Side-Reach Wall-Mounted Telephones: 54 inches above finished floor to top of telephone.
 - 3) Telephone Outlets for Forward-Reach Wall-Mounted Telephones: 48 inches above finished floor to top of telephone.
 - b. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
 - c. Unless otherwise indicated, provide separate outlet boxes for line voltage and low voltage devices.

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. 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.

C. 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.

D. Identification:

1. Use wire and cable markers to identify cables at each end.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - 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. 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

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SECTION 275116 PUBLIC ADDRESS SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Amplifier and control equipment.
- B. Input equipment.
- C. Sound system cable.
- D. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 05 33.16 - Boxes for Electrical Systems.

1.03 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SYSTEM DESCRIPTION

- A. Public address system for voice and music.
- B. Input components:
 - 1. Compact disc player.
 - 2. AM/FM tuner.
 - 3. Microphone.
- C. Features:
 - 1. Interface to telephone system.
 - 2. One-way paging by zone.
 - 3. Emergency paging override.
 - 4. Distribution of background music.
 - 5. Selective speaker talkback.

1.05 SUBMITTALS

- A. Shop Drawings: Indicate electrical characteristics and connection requirements. Indicate layout of equipment mounted in racks and cabinets, component interconnecting wiring, and wiring diagrams of field wiring to speakers and remote input devices.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70 and Federal Communications Commission.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Bogen Communications, Inc: www.bogen.com/#sle.
- B. Toa Electronics, Inc: www.toaelectronics.com/#sle.

2.02 AMPLIFICATION AND CONTROL EQUIPMENT

- A. Microphone Inputs: Two low impedance inputs with 600 microvolt sensitivity and noise level at least 55 dB below rated output.
- B. Auxiliary Inputs: One high impedance input with 0.4 volt sensitivity and noise level at least 70 dB below rated output.
- C. System Frequency Response: 50 to 15,000 Hz, plus or minus 2 dB.
- D. System Distortion: Less than 1.5 percent, 100 to 100,000 Hz at rated power.
- E. System Output: 4 ohms 25 volts.

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- F. Volume Controls: One for each input and one master volume.
- G. Bass Control: Plus 8 dB to minus 12 dB at 50 Hz.
- H. Treble Control: Plus 8 dB to minus 12 dB at 10,000 Hz.
- I. Program Selector: Provide program , listen-talk, and mode selector switches.
- J. System Cabinet: Rack mounted.

2.03 COMPONENTS

- A. Compact Disc Player: .
- B. AM/FM Tuner: Tuner with 525 to 1605 kHz AM and 88 to 108 MHz FM tuning range.
 - 1. AM Performance:
 - a. AM IF Rejection: Over 30 dB.
 - b. AM Selectivity: 7 kHz at minus 6 dB.
 - c. AM Fidelity: 100 to 4500 Hz, plus or minus 3 dB.
 - d. AM Antenna Input: 75 ohms, unbalanced.
 - 2. FM Performance:
 - a. FM IF Rejection: Over 50 dB.
 - b. FM Fidelity: 50 to 15,000 Hz, plus or minus 3 dB.
 - c. FM Antenna Input: 300 ohms, balanced.
- C. Microphone: Desk type low impedance microphone with push-to-talk switch.
 - 1. Directional Response: Unidirectional.
- D. Speakers: 8 inch coaxial speaker with integral crossover circuit.
 - 1. Power Rating: 20 watts.
 - 2. Frequency Range: 45 to 18,000 Hz.
 - 3. Sound Pressure Level: 95 dB at 3 feet with 1 watt input.
 - 4. Magnet: Ceramic; 10 ounces low frequency unit; 3 ounces high frequency unit.
- E. Speaker Baffles and Enclosure: Square, painted steel, with uniform perforations.
 - 1. Size: 12 inch.
 - 2. Finish: White.
 - 3. Speaker Backbox: Insulated with sound-deadening material.
- F. Horns: Wide dispersion indoor/outdoor horn with driver.
 - 1. Power Rating: 60 watts.
 - 2. Low Frequency Cutoff: 250 Hz.
 - 3. Sound Distribution: 20 x 50 degrees.
 - 4. Sound Pressure Level: 120 dB at 4 feet with full range input.
- G. Matching Transformers: Tapped from 0.5 to 4 watts in 1 watt steps, with primary/secondary ratio to match amplifier to speaker impedances.
- H. Volume Pads: Transformer type rated 10 watts.
- I. Telephone Interface: 600 ohm - auxiliary input.
- J. Equipment Rack: Floor mounted equipment rack.
 - 1. Equipment Mounting Width: 19 inch.

2.04 WIRE AND CABLE

- A. Microphone Cord: 20 AWG stranded copper conductor, 600 volt insulation, rated 60 degrees C, two conductor shielded cable with rubber jacket.
- B. Input Cable: 22 AWG copper conductor, 300 volt insulation, rated 60 degrees C, paired conductors twisted together, shielded, and covered with a PVC jacket.
- C. Speaker Wire and Cable: 22 AWG copper conductor, 300 volt insulation, rated 60 degrees C, paired conductors twisted together shielded and covered with a PVC jacket.
- D. Plenum Cable for Speaker Circuits: 22 AWG copper conductor, 300 volt insulation, rated 200 degrees C, paired conductors twisted together shielded and covered with a nonmetallic jacket; suitable for use for Class 2 circuits in air handling ducts, hollow spaces used as ducts, and plenums.

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PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Splice cable only in accessible junction boxes or at terminal block units.
- C. Make cable shields continuous at splices and connect speaker circuit shield to equipment ground only at amplifier.
- D. Install input circuits in separate cables and raceways from output circuits.
- E. Provide protection for exposed cables where subject to damage.
- F. Use armored cable for outside speaker circuits.
- G. Support cables above accessible ceilings to keep them from resting on ceiling tiles. Use spring metal clips or plastic cable ties to support cables from structure for ceiling suspension system. Include bridle rings or drive rings.
- H. Use suitable cable fittings and connectors.
- I. Connect reproducers to amplifier with matching transformers.
- J. Ground and bond equipment and circuits in accordance with Section 26 05 26.

3.02 ADJUSTING

- A. Adjust transformer taps for appropriate sound level.
- B. Adjust devices and wall plates to be flush and level.

END OF SECTION

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SECTION 275119 SOUND MASKING SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sound masking system.
 - 1. Includes integrated paging and background music distribution capability.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 27 51 16 - Public Address Systems: Paging/music equipment for interface with sound masking system.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. 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.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of loudspeakers with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
 - 2. Coordinate the placement of wall controls with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include ratings, configurations, standard wiring diagrams, outline and support point 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, attachment locations and details, and proposed size, type, and routing of conduits and/or cables. Include system interconnection schematic diagrams and proposed arrangement of loudspeaker control zones.

1.06 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.
- B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

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- B. Provide minimum five year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 SOUND MASKING SYSTEM REQUIREMENTS

- A. Provide complete sound masking system consisting of noise generators, equalizers, amplifiers, loudspeakers, wiring, supports and other components necessary for meeting specified sound masking requirements in areas indicated on the drawings.
- B. General Requirements:
 - 1. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - 2. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system.
 - 3. System Components Installed in Spaces Used for Environmental Air: Plenum rated; listed and labeled as complying with UL 2043, suitable for use in air-handling spaces.
- C. Masking Sound Generation and Distribution Requirements:
 - 1. Provide random or pseudo-random masking sounds with a repetitive pattern of not less than 24 hours.
 - 2. Arrange system into masking control zones (independently controlled groups of loudspeakers) based on common installation conditions as indicated on the drawings.
 - a. Masking sound volume for each masking control zone to be adjustable in 0.5 dBA increments over a range of 35 dBA to 55 dBA at a distance of 3.3 feet (1 m).
- D. Paging and Background Music Distribution Requirements:
 - 1. Capable of interfacing with paging/music equipment as specified in Section 27 51 16 for distribution of paging or background music signals simultaneously with, and without interruption of, the masking sound signal.
 - 2. For each masking device, provide separate volume and octave band equalization controls for paging/background music signals that are independent of masking sound controls.
- E. System Control and Monitoring Requirements:
 - 1. Provide a PC interface for monitoring, displaying, reporting, and adjusting system settings.
 - 2. Provide automatic timer controls for automatically adjusting sound masking volume levels according to a programmed schedule.
 - 3. Provide wall-mounted controls to allow occupants to manually adjust volume of local loudspeakers in designated rooms.
 - 4. Provide security features to prevent unauthorized changes to or loss of system control settings.
 - a. Provide a locked enclosure or cabinet for readily accessible electronic components.
 - b. Provide password protection for access to programmable controls with a means for backing up settings.
- F. Loudspeaker Appearance:
 - 1. Finish - Recessed in Ceiling: White.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that ratings and configurations of system components are consistent with the indicated requirements.
- C. Verify that loudspeaker locations indicated are free from obstructions and meet manufacturer's minimum clearance requirements.
- D. Verify that mounting surfaces are ready to receive system components.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to system.
- F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).

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- B. Install products in accordance with manufacturer's instructions.
- C. Provide required support and attachment in accordance with Section 26 05 29.
- D. Mount loudspeakers with clearances within manufacturer's recommended range.
- E. Install loudspeakers level and plumb.
- F. Provide grounding and bonding in accordance with Section 26 05 26.
- G. Identify system wiring and components in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Before performing system startup, measure sound levels under specified test conditions. Identify and report building noises that exceed the specified preferred spectrum.
- C. Prepare and start system in accordance with manufacturer's instructions. Correct defective work and adjust for compliance with specified requirements.
- D. Adjust settings for paging/music as directed by Owner.
- E. Adjust settings for automatic timer controls as directed by Owner.

3.04 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.
- B. Training: Train Owner's personnel on operation, adjustment, and maintenance of sound masking system.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

3.06 PROTECTION

- A. Protect installed system components from subsequent construction operations.

END OF SECTION

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SECTION 275129.13 RESCUE ASSISTANCE SIGNAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Area of refuge/rescue assistance emergency communication system and associated call stations, control stations, and accessories.
 - 1. Includes area of refuge/rescue assistance signage.

1.02 RELATED REQUIREMENTS

- A. Section 07 84 00 - Firestopping.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 33.13 - Conduit for Electrical Systems.
- D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- C. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.
- G. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment or other potential obstructions within the spaces dedicated for area of refuge/rescue assistance system components.
 - 2. Coordinate the work with other installers to provide communication lines required for control station timed automatic connection to designated constantly attended monitoring location.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install call stations and control station(s) until final surface finishes and painting are complete.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.
- C. Design Data: Include standby battery calculations.
- D. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

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1.06 QUALITY ASSURANCE

- A. Comply with the following:
 - 1. ADA Standards.
 - 2. NFPA 70 (National Electrical Code).
 - 3. The requirements of the State Fire Marshal.
 - 4. The requirements of the local authorities having jurisdiction.
 - 5. Applicable TIA/EIA standards.
- B. Installer Qualifications: Company with minimum three years documented experience with similar area of refuge/rescue assistance systems and providing contract maintenance service as a regular part of their business; manufacturer's authorized installer.
- C. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.
- B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

- A. See Section 01 78 00 - 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

2.01 AREA OF REFUGE/RESCUE ASSISTANCE COMMUNICATION SYSTEM

- A. Provide new area of refuge/rescue assistance communication system consisting of all required equipment, conduit, boxes, wiring, connectors, hardware, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. System Description:
 - 1. Call Stations: Located at each designated area of refuge/rescue assistance as indicated on drawings, unless otherwise directed by authorities having jurisdiction.
 - 2. Master Control Station: New, located as indicated on drawings, unless otherwise directed by authorities having jurisdiction.
 - 3. System battery backup is required.
 - 4. Timed automatic connection to designated constantly attended monitoring location is required.
 - 5. Interface with Other Equipment:
- C. System Operation:
 - 1. When a call for assistance is initiated at call station:
 - a. Provide audible and visual notification at call station to confirm that call has been placed.
 - b. Provide audible and visual notification at control station(s) that call has been placed and annunciate the location of the call station/zone that initiated a call.
 - c. Maintain visual notification of each call location at control station(s) until manually reset by control station operator.
 - d. Maintain audible notification at control station(s) that call(s) have been placed until call is acknowledged by control station operator.
 - e. Maintain visual notification at call station until manually reset by control station operator.
 - 2. When a call for assistance is acknowledged at control station:
 - a. Provide visual notification at control station that call has been acknowledged.
 - b. Provide visual notification at call station that call has been received.
 - c. Establish two-way voice communication between call station and control station.
 - 3. When a call has not been acknowledged during a programmed time delay to allow for local response, automatically initiate call to listed remote monitoring station under contract with facility, send signal identifying specific building, and establish two-way voice communication.

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- D. Call Station(s):
 - 1. Vandal resistant, with tamper proof hardware.
 - 2. Suitable for the environment where installed.
 - 3. Finish: Painted steel or stainless steel.
 - 4. Provides means to initiate call for assistance.
 - 5. Provides for distinct audible and visual notification to confirm that call has been placed and for distinct visual notification that call has been acknowledged.
 - 6. Following initial call for assistance, provides for hands-free two-way communication with control station(s).
- E. Control Station(s):
 - 1. Suitable for the environment where installed.
 - 2. Provides visual notification that system is operational.
 - 3. Provides for distinct audible and visual notification of calls with annunciation of call station/zone locations.
 - 4. Provides for two-way communication with selected call stations.
 - 5. Provides for supervision of system wiring and provides distinct audible and visual notification of faults.
 - 6. Audible Notification Sound Level: Not less than 90 dB.
- F. Accessories:
 - 1. Provide components as indicated or as required for a complete operating system.
 - 2. Wiring: Provide manufacturer's recommended cables as indicated or as required for connections between system components, and in accordance with wiring methods indicated.
 - 3. Signage:
 - a. Call Station Instruction Signs: Raised character and Braille instructions complying with ADA Standards.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that characteristics of system components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive system components.
- 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. Mounting Heights:
 - 1. Call Stations: As indicated on drawings.
 - 2. Control Stations: As indicated on drawings.
- D. Provide grounding and bonding in accordance with Section 26 05 26.
- E. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
- F. Identify system wiring and components in accordance with Section 26 05 53.
- G. Identify zones at control station(s) to indicate call station locations.
- H. Provide required instructional signage at each call station.

3.03 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

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3.04 PROTECTION

- A. Protect installed system components from subsequent construction operations.

END OF SECTION

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SECTION 275313 CLOCK SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Clock system requirements.
- B. Wireless clock systems and associated components:
 - 1. Master clock unit.
 - 2. Wireless secondary indicating clocks.
- C. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 84 00 - Firestopping.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 33.13 - Conduit for Electrical Systems.
- D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 27 51 16 - Public Address Systems: For interface with clock system.
- F. Section 27 51 23 - Intercommunications and Program Systems: For interface with clock system.

1.03 REFERENCE STANDARDS

- A. 47 CFR 15 - Radio Frequency Devices; current edition.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of clocks with potential conflicts and/or view obstructions installed under other sections or by others.
 - 2. Coordinate the work with other installers to provide power for clocks and equipment at required locations.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.

1.06 QUALITY ASSURANCE

- A. Comply with the following:
 - 1. NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.
- B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

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1.09 WARRANTY

- A. See Section 01 78 00 - 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

2.01 CLOCK SYSTEM REQUIREMENTS

- A. Provide new clock system consisting of all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B, consumer application.

2.02 WIRELESS CLOCK SYSTEMS

- A. Manufacturers:
 - 1. Wireless Clock System:
 - a. American Time: www.american-time.com/#sle.
 - b. Midwest Time Control: www.midwest-time.com/#sle.
 - c. The Sapling Company, Inc: www.sapling-inc.com/#sle.
- B. Master Clock Unit:
 - 1. Description: Microprocessor-based controller and associated accessories for maintaining time reference and correcting connected wireless secondary indicating clocks.
 - 2. Acceptable Time Reference Source(s): Based on Network Time Protocol (NTP) server time data obtained via local area network (LAN) or Global Positioning System (GPS) satellite antenna/receiver.
 - 3. Wireless Time Correction Signal Transmitter/Antenna: Compatible with wireless secondary clocks, including any existing clocks (where indicated).
- C. Provide components as indicated or as required for extension of wireless time correction signal between master clock unit and wireless secondary indicating clocks.

2.03 ACCESSORIES

- A. Provide components and wiring as indicated or as required for connection to auxiliary devices and other systems indicated.
- B. Protective Covers/Guards for Clocks: Where indicated.
- C. Racks/Cabinets: Provide as indicated or as required for equipment mounting.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that characteristics of system components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive system components.
- 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. Provide grounding and bonding in accordance with Section 26 05 26.
- D. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
- E. Identify system wiring and components in accordance with Section 26 05 53.

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3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Prepare and start system in accordance with manufacturer's instructions.
- C. Program system parameters according to requirements of Owner.
- D. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.
- E. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.04 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.
- B. Training: Train Owner's personnel on operation, adjustment, 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.

3.05 PROTECTION

- A. Protect installed system components from subsequent construction operations.

3.06 MAINTENANCE

- A. Conduct site visit upon Owner's request within one year from Date of Substantial Completion to make additional adjustments to system programming.

END OF SECTION

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SECTION 280000 GENERAL LOW VOLTAGE REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. Applicable provisions of Division 1 shall govern all work under this Section.
- B. Section Includes: Basic Low Voltage Requirements which are applicable to all Division 28 sections. This section includes information common to two or more technical specification sections or items that are of a general nature, not conveniently fitting into other technical sections.
- C. Related Sections to all of Div 28- the following sections are of special note:
 - 1. Division 01 General Conditions.
 - 2. Division 8 Doors and Frames.
 - 3. Division 8 Automatic Door Operators.
 - 4. Division 8 Door Hardware.
 - 5. Division 26 Electrical.
 - 6. Division 27 Communications.
- D. Reference Standards - Abbreviations of standards organizations referenced in this and other sections are as follows:
 - 1. ANSI, American National Standards Institute
 - 2. ASTM, American Society for Testing and Materials
 - 3. EIA, Electronics Industry Association
 - 4. EPA, Environmental Protection Agency
 - 5. ETL, Electrical Testing Laboratories, Inc.
 - 6. FCC, Federal Communications Commission.
 - 7. IEEE, Institute of Electrical and Electronics Engineers
 - 8. ISA, Instrument Society of America
 - 9. NBS, National Bureau of Standards
 - 10. CEC, California Electric Code
 - 11. NEMA, National Electrical Manufacturers Association
 - 12. NFPA, National Fire Protection Association
 - 13. UL, Underwriters Laboratories Inc.
- E. REGULATORY REQUIREMENTS
 - 1. All work and materials are to conform in every detail to applicable rules and requirements of the National Electrical Code (ANSI/(NFPA 70))), other applicable National Fire Protection Association codes, and present manufacturing standards (including NEMA).
- F. QUALITY ASSURANCE
 - 1. Substitution of Materials: Refer to Division 1 - General Conditions of the Contract
 - 2. All materials shall be listed by and shall bear the label of an approved electrical testing laboratory. If none of the approved electrical testing laboratories has published standards for a particular item, then other national independent testing standards, subject to approval of the Owner's Representative, shall apply and such items shall bear those labels. Where one of the approved electrical testing laboratories has an applicable system listing and label, the entire system shall be so labeled. Approved or listed electrical testing laboratories shall be one of the following:
 - a. Factory Mutual Laboratories (FM).
 - b. Underwriters Laboratories, Inc. (UL).
 - c. National Electrical Manufacturers Association (NEMA).
- G. CODES, PERMITS AND FEES
 - 1. Refer also to General Conditions of the Contract, Quality Control and Inspection.
 - 2. The installation of this work shall comply in every way with the requirements of the laws, ordinances and rules of the State of California, OSHA, the National Board of Fire Underwriters, and the California Electrical Code.
 - 3. Obtain all required State and local installation inspections. Deliver originals of these certificates to the Owner's Project Representative. Include copies of the certificates in the Operating and Maintenance Instructions.

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1.02 INTENT

- A. It is the intent that the Low Voltage Security Electronics Contractor provide the systems indicated in the following specifications sections:
 - 1. 28 00 00 General Low Voltage Requirements.
 - 2. 28 05 01 Equipment Enclosures.
 - 3. 28 05 13 Low Voltage Wire and Cable.
 - 4. 28 05 20 Low Voltage Devices.
 - 5. 28 05 26 Low Voltage Grounding and Bonding.
 - 6. 28 05 28 Low Voltage Security Conduit.
 - 7. 28 05 29 Low Voltage Supporting Devices.
 - 8. 28 05 53 Low Voltage Identification.
 - 9. 28 23 00 Digital Video System.
 - 10. 28 50 00 Security Management System
- B. The Contractor shall furnish and install all the necessary materials, apparatus, and devices to complete the low voltage electronics equipment and systems installation herein specified.
- C. All details and drawings are diagrammatic, and do not include every interconnect and equipment requirement. The Contractor shall provide all necessary equipment, interfaces, integration, installation, and programming for a complete and operable system.
- D. All sizes given are minimum except as noted.
- E. Materials and labor shall be new (unless noted or stated otherwise), first class, and workmanlike, and shall always be subject to the Owner's Representative's and/or A/E's inspections, tests and approval from the commencement until the acceptance of the completed work.
- F. Whenever a particular manufacturer's product is named, it is mentioned only to indicate the type, quality and function of the article which will meet the intent of the specifications, unless specifically indicated to meet justified needs of the client, facility, or community. See General Conditions of the Contract for Substitutions.
- G. Software: All software shall be formatted, installed, and programmed in compliance with the Contract Documents and the recommendations of the respective Manufacturer's.

1.03 DEFINITIONS

- A. The following items, when used in Division 28 of the specifications and on the accompanying drawings, shall be construed to mean as follows:
 - 1. Contractor: the contractor for the low voltage security electronics work.
 - 2. Systems Installer, Low Voltage Systems Installer, or LVSE System Installer: the firm, licensed by the State to perform installation of low voltage security electronics systems, which is responsible for immediate supervision and installation of low voltage security electronics work on the project.
 - 3. Provide: Furnish and install, completely ready for use, including all accessories required for operation.
 - 4. Furnish: Purchase and deliver to the project site complete with every necessary appurtenance, support and accessory required for operation.
 - 5. Install: Unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project.
 - 6. Concealed: Embedded in masonry or other construction installed behind wall furring, with double partitions or hung ceilings, in crawl spaces, in shafts.
 - 7. Exposed: Not concealed.
 - 8. Underground: Buried within earth, more than 5'0" exterior to building foundations.
 - 9. Underslab: Buried within earth, interior to building foundations.
 - 10. Listed: Equipment is "listed" if of a kind mentioned in a list which:
 - a. Is published by a nationally recognized laboratory which makes periodic inspection of the production of such equipment.
 - b. States that such equipment meets nationally recognized standards or has been tested and found safe for use in a specified manner.
 - 11. Labeled: Equipment is "labeled" if:
 - a. It embodies a valid label, symbol, or other identifying mark of a nationally recognized testing laboratory such as Underwriters' Laboratories, Inc.
 - b. The laboratory makes periodic inspections of the production of such equipment.

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- c. The labeling indicates compliance with nationally recognized standards or tests to determine safe use in a specified manner.
12. Certified: Equipment is "certified" if:
 - a. Equipment has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specified manner.
 - b. Production is periodically inspected by a nationally recognized testing laboratory.
 - c. It bears a label, tag, or other record of certification.
13. Nationally recognized testing laboratory: A testing laboratory which is approved, in accordance with OSHA regulations, by the Secretary of Labor.
14. Line Voltage: For the purposes of Division 28, line voltage is defined as circuits operating at 120 volts nominal or greater.
15. Manufacturer's Representative: Individual certified, in writing, by the equipment manufacturer to be knowledgeable and thoroughly familiar with the installation, programming (if required), testing and troubleshooting of the specific equipment and system configuration installed. If the individual is one other than an employee of the equipment manufacturer, then written certificates proving manufacturer certification must be provided.

1.04 PROJECT/SITE CONDITIONS

- A. Install Work in locations shown on Drawings, unless prevented by Project conditions.
- B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of the Owner's Representative before proceeding.

1.05 WORK BY OTHER TRADES

- A. Every attempt has been made to indicate in this trade's specifications and drawings all work required of this Contractor. However, there may be additional specific paragraphs in other trade specifications and addenda, and additional notes on drawings for other trades which pertain to this Trade's work, and thus those additional requirements are hereby made a part of these specifications and drawings.
- B. Low voltage electronics details on drawings for equipment to be provided by others is based on preliminary design data only. This Contractor shall lay out the low voltage electronics work and shall be responsible for its correctness to match equipment actually provided by others.

1.06 CONTRACT DRAWINGS

- A. The contract drawings indicate the extent of low voltage electronics work and the approximate locations and arrangement of the low voltage equipment and devices. The drawings do not necessarily show the exact number of raceways, junction boxes, or outlet boxes for the circuits required, nor does it show the exact routing of the circuits and conduit. The contractor shall field verify routing requirements and coordinate those requirements with other trades as indicated in the paragraph titled COORDINATION. The contractor shall provide all raceways, boxes, conductors, connections, supports, and all other materials required for the low voltage systems shown or noted in the contract documents to be complete and fully operational upon completion of the project.
- B. The specifications and drawings are complimentary and what is required in either is as binding as if indicated on both. Where a conflict or discrepancy exists between the drawings and the specifications, the most stringent shall apply.

1.07 RECORD DRAWINGS

- A. The Contractor shall maintain at least one copy each of the specifications and drawings on the job site at all times.
- B. See Division 1, GENERAL REQUIREMENTS for additional requirements regarding record drawings.
- C. The Contractor shall maintain a suitable set of contract drawings on site, which daily records of changes and deviations from contract shall be recorded. All buried or concealed piping, conduit, or similar items shall be located by dimensions and elevations on the record drawings.
- D. The daily record of changes shall be the responsibility of Contractor's field superintendent. No arbitrary mark-ups will be permitted.
- E. During the first week of each month, the Contractor shall present, at the project site, the job copy showing variations and changes to date to the Owner's Representative for their review.

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- F. At completion of the project, the Contractor shall submit a final set of as-built drawings, which incorporate the marked-ups of the record drawings. These final as-built drawings shall be provided to the Owner's Representative (in hard copy and AutoCAD format) prior to final payment.

1.08 WARRANTY

- A. The Contractor shall warrant the installation to be free from defects in materials and workmanship for a period of two years from Date of Substantial Completion.
- B. During the warranty period, all service (including equipment, labor, travel, expenses, etc.) is to be provided during normal and after working hours at no cost to the Owner.
- C. The integrator shall provide the Owner a phone response within 8 business hours of receipt of service call.

1.09 MAINTENANCE SERVICE

- A. A minimum of 60 days prior to the expiration of the warranty, the integrator shall provide a proposal to Owner to provide service and maintenance of the low voltage system installation on a yearly basis. The Owner will be under no obligation to accept the maintenance service proposal.

1.10 MAINTENANCE MATERIALS

- A. Provide maintenance materials under the provisions of the General Conditions.
- B. Furnish one set of tools required for preventative maintenance of the low voltage electronics system. Package tools in adequately sized metal tool box.
- C. Provide spare parts as identified in each individual specification sections.

1.11 REQUIRED QUALIFICATIONS

- A. The following minimum qualifications must be met by the Security Systems Integrator as noted below:
 - 1. The Security System Integrator must have a minimum of five (5) years documented experience furnishing and/or servicing Access Control and IP based Video Management Systems from one of the Customer's pre-qualified Access and VMS vendors.
 - a. The Pre-Qualified Access Control Vendors are:
 - 1) RS2
 - b. The Pre-Qualified VMS Software Vendors are:
 - 1) Avigilon
 - 2. The Security System Integrator must have a minimum of five (5) years documented experience furnishing advanced programming and software integration of Lenel OnGuard Access Control Systems.
 - 3. The Security System Integrator must have a complete internal software support team that has the ability to provide onsite and offsite continued support of both software platforms. This team shall have certifications in Microsoft, Microsoft SQL database, and Oracle Database.
 - 4. The Security System Integrator must have completed at least four (4) projects of this size or greater with complete integration to both the Access Control System and the VMS within the last calendar year.
 - 5. The Security System Integrator or team member must have a minimum of five (5) employees that have current manufacturer certification and at least one (1) current master certification from one (1) or more of the pre-qualified system vendors whose products will be used by the Security System Integrator on this project and have maintained that certification for a minimum of one (1) year. One (1) of these team members must be on-site anytime installation and configuration of the system is underway.
 - 6. The Security Systems Integrator must hold a current national footprint and have a servicing location within 1 hour of the site and provide local on-site service at the customer within four hours of a service request 24 hours a day, 365 days a year.
 - 7. The Security System Integrator must have a local office equipped to produce CAD drawings and provide sales and management support.
 - 8. The below integrators are the preferred integrators by the Owner:
 - a. Current Solutions
 - 1) Preferred integrator for Access Control, Verkada Cameras, and Duress systems
 - b. Kubl Group
 - 1) Preferred integrator for Avigilon Video Surveillance system

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PART 2 PRODUCTS

2.01 SUBMITTALS

A. General:

1. The contractor may use the design documents as a basis for all submittals and shop drawings. Electronic copies of Division 28 site plan and floor plans will be made available to the contractor in AutoCAD, free of charge, for contractor use. Provide a written statement to the Security Electronics Designer along with a list of the requested documents. Contractor is responsible for facilitating the means of delivery (ftp site, sharefile site, etc.).

B. Construction Submittals:

1. Provide product data sheet(s) for each type of product specified within Division 28 of these specifications. All data sheets showing shall be clearly marked identifying the specific product or model being proposed. Provide original data sheets only. Fax copies are not acceptable. Product data sheets shall include the specification section that the product is located in at the top of each data sheet. Product data sheets shall be provided electronically with tab sheets identifying each specification section. Product data sheets shall be provided in pdf format, and shall be provided via email, or via secure ftp site.
2. Submit the above required information for all equipment and systems as indicated above and in the respective specification sections, marking each submittal with that specification section number and item sub-number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Failure to do this will result in the submittal(s) being returned to the Contractor for correction and resubmission. Failing to follow these instructions does not relieve the Contractor from the requirement of meeting the project schedule.
3. Shop drawings, detailing the security electronics system including but not limited to the following:
 - a. All drawings shall be drawn to scale that detail racks, enclosures, and/or field devices. All devices shall be shown.
 - b. All shop drawings generated for this project shall be created utilizing Auto-CAD 2014 or greater file format. Drawings shall be submitted on sheet sizes the same size as the contract documents.
 - c. Drawings shall be provided for each field device detailing wiring and mounting instructions.
 - d. Point-to-point wiring data shall be provided, utilizing a combination of Auto-CAD generated drawings and security control point schedules. The schedules shall be created with Microsoft Excel and shall cross-reference AutoCAD drawings as required. Schedules shall detail all equipment being provided and controlled/monitored by the security electronics system. The schedules shall be organized according to different system functionality. Typical schedules shall include, but not be limited to, sections for cabling information, control locations, door hardware interface, intercom, cameras, surveillance monitors, intrusion detection and access control. The drawings and schedules shall indicate the wiring of components and all connections to be made. Terminal connections in the equipment shall be numbered to correspond to drawings and schedules for use in making connections. All schedules shall be included with the product data sheets as previously described, and all products shall be cross referenced to plans and schedules.
 - e. Provide a system and network architecture drawing showing the following:
 - 1) Physical network topology for each networked system.
 - 2) Software architecture for each networked system.
 - f. Drawings of equipment cabinet(s) or racks shall detail the arrangement of all components installed.
 - g. Provide power distribution and power loading detail drawings. Provide power calculations for the total system and for each security electronics equipment room.
 - h. Provide overall Security System Riser, Access Control System Riser, Network Riser, Video Riser and Power Distribution System Riser diagrams. Drawings shall include all interconnecting wiring, cable types and sizing. Provide manufacturers wire type where required.
4. Provide wiring diagrams, detailing wiring for power, signal and control, differentiating clearly between manufacturers installed wiring and field installed wiring. Identify terminals to facilitate installation, operation, and maintenance.
5. Submittals shall be grouped to include complete submittals of related systems, products, and accessories in a single submittal. Mark dimensions and values in units to match those specified. Include wiring diagrams of electrically powered equipment.
6. The above submittals must be approved before fabrication or installation is authorized.

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7. Review comments shall not relieve Contractor from responsibility for deviations from Contract Documents unless attention has been called to such deviations in writing at time of submission, nor shall they relieve this Contractor from responsibility for errors in items submitted.
- C. Project Close-out Submittals and As-Built Documentation:
1. Shop drawings shall be updated to conform to actual installation.
 2. Network addressing: All IP based equipment shall be scheduled to include the following:
 - a. Switch designation;
 - b. Switch port number;
 - c. Device number;
 - d. IP address;
 - e. Network subnet mask;
 - f. MAC address.

2.02 OPERATING AND MAINTENANCE MANUALS

- A. See Division 1, GENERAL REQUIREMENTS - Operating and Maintenance Instructions for additional requirements.
- B. Assemble material in three-ring or post binders, using an index at the front of each volume and tabs for each system or type of equipment. In addition to the data indicated in the General Requirements, include the following information:
1. Copies of all approved submittals.
 2. Manufacturer's wiring diagrams for electrically powered equipment.
 3. Point-to-point diagrams, wiring diagrams, and construction details for all built-up equipment.
 4. A complete list of Access Control System card reader / hardware configuration and input / output points referencing each field device being controlled and/or monitored.
 5. Installation and operating instructions.
 6. Records of tests performed to certify compliance with system requirements.
 7. Parts lists for manufactured equipment.
 8. Preventive maintenance recommendations and servicing data.
 9. Copies of all component warranties and installation warranties.
 10. Additional information as indicated in the technical specification sections.
 11. Emergency instructions for operational and maintenance requirements.
- C. Provide a "software binder" to the Owner upon final system turnover.
1. This software binder shall consist of a three ring, hard cover binder that shall include at a minimum, the following items; all computer manufacturer's back- up/recovery discs, access control system software driver disc, video surveillance software driver disc and drivers for peripheral equipment (i.e. printers).
 2. The software binder shall include all software and licenses for each system included within these specifications.
 3. Original passwords (provided at time of final completion) provided to access devices such as Video Surveillance Software, Access Control System Server, digital video recording client software, etc., shall be provided in document format.
 4. All updated as-built drawings, to include plans, point-to-points, wiring diagrams, and construction details. These are to be provided in both pdf and AutoCAD format.
- D. Reference individual Specification Sections for additional requirements.
- E. All above noted documentation will be provided to the Owner's Representative for review and verification. Only after verification and approval of the accuracy and completeness of the information provide will the Owner's Representative provide authorization to the Owner to release final payment.
- F. All above noted documentation will be provided to the Owner's Representative as a digital copy on five (5) USB flash drives.

PART 3 EXECUTION

3.01 INSTALLATION OF LOW VOLTAGE ELECTRONICS SYSTEMS

- A. Electronic equipment installed in control rooms and low voltage electronics rooms shall not be installed until after the environment is free of all dust. A dust free environment shall be defined as follows:
1. All concrete, gypsum wallboard, and tile cutting, and patching is complete or other dust producing construction operation is complete.
 2. All fireproofing is complete.

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3. All painting is complete.
 4. All ceiling materials are installed.
 5. All air handling systems serving these areas have been in operation for at least one week, and the filters have been changed at least once prior to electronics equipment installation.
- B. All cabling for systems indicated in these specifications shall be installed in conduit, unless indicated otherwise elsewhere within these specifications.

3.02 PROTECTION OF FINISHED SURFACES

- A. See Division 1, GENERAL REQUIREMENTS for Protection of Finished Construction for additional requirements.

3.03 CUTTING AND PATCHING

- A. See Division 1, GENERAL REQUIREMENTS - Cutting and Patching.

3.04 BUILDING ACCESS

- A. Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was not previously arranged and must be provided by this contractor, restore any opening to its original condition after the apparatus has been brought into the building.

3.05 EQUIPMENT ACCESS

- A. Install all piping, conduit, ductwork, panels, and accessories to permit access to equipment for maintenance. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Where access is required in plaster or drywall walls or ceilings, coordinate with the General Contractor for installation of those access doors.
- B. Working Clearances: Minimum installed equipment working clearances as required by the CEC Table 110-34(a) shall be used. The clearances shall be based on phase-to-phase voltage and condition 3 of that table. As a minimum, there shall be 3 feet of clearance in front of all panels and enclosures.

3.06 COORDINATION

- A. The Contractor shall cooperate with other trades and the Owner's Representative in locating work in a proper manner. Should it be necessary to raise or lower or move longitudinally any part of the low voltage work to better fit the general installation, such work shall be done at no extra cost to the Owner. The Contractor shall check location of low voltage devices with respect to other installations before installing.
- B. The Contractor shall verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to, cameras, panels and enclosures, pushbuttons, card readers, etc.
- C. Coordinate all work with other contractors prior to installation. Any installed work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.

3.07 TRAINING OF USER AGENCY'S PERSONNEL

- A. Instruct user agency's personnel in the proper operation of systems and equipment provided as part of this project. Include not less than four (4) hours of instruction. Demonstrate startup and shutdown procedures for all equipment. All training to be during normal working hours.
- B. Instruct user agency's personnel in the proper maintenance of systems and equipment provided as part of this project. Include not less than four (4) hours of instruction, using the Operating and Maintenance manuals during this instruction. Demonstrate startup and shutdown procedures for all equipment. All training to be during normal working hours.
- C. Prior to training, this contractor will provide a detailed agenda outlining the "hands-on" training sessions to be provided to the Owner. The operation, programming/debugging, troubleshooting, repair and maintenance of all systems shall be covered.

3.08 HOUSEKEEPING AND CLEAN UP

- A. See Division 1, GENERAL REQUIREMENTS - Cleaning for additional requirements.
1. The Contractor shall clean up and remove from the premises, on a daily basis, all debris and rubbish resulting from its work and shall repair all damage to new and existing equipment resulting from its work. When job is complete, this Contractor shall remove all tools, excess material and

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equipment, etc., from the site.

3.09 TESTING AND VERIFICATION

- A. Verification by Test and Demonstration: The Contractor shall verify by demonstrations or tests that the requirements of this Specification have been met. All demonstrations and testing shall be witnessed by the Owner's Representative.
- B. The Owner's Representative shall be notified in writing at least fourteen days in advance of all testing. Should the Owner's Representative be unable to attend, the testing shall be re-scheduled at the convenience of both the Contractor and the Owner's Representative.
- C. Field Testing and Final Acceptance: Following installation and on-site Contractor testing, the Contractor shall perform the following tests, after installation and prior to Substantial Completion, in the presence of the Owner's Representative to ensure operation in accordance with the contract documents:
 - 1. Test of all CPUs, workstations, peripherals, and all panel control functions.
 - 2. Test of all alarm initiating devices and door control operations.
 - 3. Test of video surveillance system components, cameras, switchers, and monitors.
 - 4. Test of access control system to include all related systems.
 - 5. Visual inspection of all wiring.
 - 6. Complete operation tests under emergency power, including switchover from normal to emergency power.
 - 7. Demonstrate and test system network failure modes.
 - 8. Verification of systems response time.
 - 9. Refer to each specification section for additional testing requirements.
- D. In the event that the Architect and/or Engineer are required to witness a retest at a later date because the Contractor is not adequately prepared to conduct the acceptance tests or because the systems being tested have failed such tests, which shall be solely determined by the Architect, the costs of witnessing additional tests (based on time, travel expenses, and materials at the established rates of the Architect and Engineer) shall be borne exclusively by the Contractor. In such an event, a change order to the General Construction Contract will be executed for compensation of the Architect and Engineer witnessing the tests.

END OF SECTION

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SECTION 280501 EQUIPMENT ENCLOSURES

PART 1 GENERAL

1.01 SUMMARY

- A. Applicable provisions of Division 1 shall govern all work under this Section.
- B. Section Includes:
 - 1. Equipment enclosures.
 - 2. Equipment Racks.
 - 3. Terminal Strips.
 - 4. Power Supplies.
 - 5. Electrical Boxes.
- C. Related Sections:
 - 1. The General Low Voltage Requirements, Section 28 00 00, are part of this Section, and the contract for this work, and apply to this Section as fully as if repeated herein.

1.02 SUBMITTALS

- A. Submit product data under provisions of Section 28 00 00 and Division 1.
- B. Include dimensioned shop drawings and wiring diagrams.
 - 1. Provide detailed shop drawings for each low voltage security electronics room or equipment room with low voltage security electronics equipment. Shop drawings shall include:
 - a. Equipment racks, equipment enclosures, control cabinets, floor mounted equipment, and wall mounted equipment.
 - b. Electrical panels (Division 26), and UPS and Maintenance ByPass Switches (Division 26).
 - 2. Provide dimensioned elevations for all equipment racks:
 - a. Include front and rear elevations of all equipment racks detailing each rack space.
 - b. Include dimensioned backplane layouts for all relays, power supplies, terminal blocks, Class 1 and Class 2 wireways, and other related equipment.
 - 3. Provide dimensioned elevations for all wall mounted equipment enclosures:
 - a. Include dimensioned backplane layouts for all relays, power supplies, terminal blocks, Class 1 and Class 2 wireways, and other related equipment.
- C. Product Data: Provide dimensions, ratings, performance data, weights and accessory information for each type.

1.03 REGULATORY REQUIREMENTS

- A. Equipment enclosures and racks shall be assembled of UL listed materials.
- B. Custom fabricated enclosures shall be assembled by a UL 508 certified shop.

1.04 REFERENCE STANDARDS

- A. UL 508 - Industrial Control Equipment; Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 EQUIPMENT ENCLOSURES

- A. Access Control Equipment Enclosure Cabinets:
 - 1. Construction: 14 gauge steel, with integral door and body stiffeners. Interior panel shall be removable. Provide locking, single point latch kits on all panels.
 - 2. Grounding: Provide grounding straps for electrical continuity between metal parts. Minimum size shall be #4.
 - 3. Finish: ANSI 61 gray polyester powder coating over phosphatized surfaces. Interior panels shall be white enamel.
 - 4. Cabinets shall be equal to Hoffman #A-48N3611 or approved equal.
- B. Hinged Cover Enclosures:
 - 1. Construction: General Purpose Enclosure, steel
 - 2. Finish: Manufacturer's standard enamel finish.
 - 3. Covers: Continuous hinge, held closed by flush latch operable by key.

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4. Back Panel: 14 gauge steel, white enamel finish; for mounting terminal blocks and electrical components.

2.02 EQUIPMENT RACKS

- A. Mount equipment as indicated on drawings in telecommunications equipment racks, refer to Division 27.

2.03 ELECTRICAL BOXES

- A. Sheet Metal Outlet Boxes: Galvanized steel, with 3/8 in male fixture studs where required.
- B. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 3/8 inch male fixture studs where required.
- C. Concrete Ceiling Boxes: Concrete type.
- D. Cast Boxes: Cast ferroalloy, deep type, gasketed cover, threaded hubs.
- E. Pull and Junction Boxes: Galvanized steel.
- F. Cast Metal Boxes for Outdoor and Wet Location Installations: Flat flanged, surface mounted raintight junction box. Galvanized cast iron box and cover with ground flange, neoprene gasket, and stainless-steel cover screws. UL listed raintight.
- G. Outlet pull boxes and junction boxes shall be minimum 4 inch square by 2 1/8 inches deep for use with 1 inch conduit and smaller. On conduit systems using 1 1/4 inch conduit or larger, pull, outlet and junction boxes shall be sized per NEC but not less than 4 11/16 inch square. Where boxes are installed in masonry walls, provide masonry boxes 3 1/2 inches deep.
- H. For telecommunication, fiber optic, security, and other low voltage cable installations the boxes shall be a minimum of 4 11/16 inches square.
- I. Sheet metal boxes larger than 12 Inches (300 mm) in any dimension shall be hinged. Hinged enclosures shall conform to NEMA standards unless noted otherwise.
- J. Outlet boxes shall be sized in according to the conduit, end device and building construction. Allow sufficient wiring space to support the conductor media and transmission characteristics in accordance with CED, EIA/TIA.
- K. Wireways shall not be used in lieu of junction boxes.

2.04 TERMINAL STRIPS

- A. Power Terminals: Unit construction type, closed-back type, rated 600 volts.
 1. Spring clamp connectors, AB 1492-L series.
- B. Signal and Control Terminals: Modular construction type, channel mounted, rated 600 volts.
 1. Spring clamp connectors, AB 1492-L series.

2.05 POWER SUPPLIES

- A. Provide one 24VDC system for each control panel. System shall include the following:
 1. Power supply units shall be shielded and grounded, and UL listed.
 2. Power supplies shall hard wired and fully enclosed in a lockable enclosure.
 3. Voltage regulation shall be +/- 3%.
 4. Minimum capacity of each power supply shall be 150VA. Power supplies shall be sized to energize and continuously operate all controls and indicators simultaneously and shall be internally protected against short circuits and overloads.
 5. Provide an external reset button.
- B. Power supply shall be UL listed.

2.06 SURGE AND LIGHTNING PROTECTION

- A. All surge protection devices shall have the lowest surge voltage rating per U.L. 1449 that is consistent with the line levels.
- B. All data, power and video signal cables entering the facility from a point exterior to the building shall be equipped with a silicon avalanche diode type of lightning protection.
- C. Protector shall be located at the first cabinet through which the cable or conductor passes upon entering the building.

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- D. 120VAC surge protection shall be installed on each non-UPS or emergency circuit feeding security devices. Provide DIN-rail mountable surge protectors equal to Transtector cat. No. DR-120.
- E. Approved surge protection manufacturers; Northern Technologies, Transtector and Ditek.

2.07 FUSEHOLDERS

- A. All electric locks shall be individually fused using industrial grade fuse holder terminal blocks mounted on DIN rail. The fuse holder shall include blown fuse indicators for both DC and AC powered doors. Fuseholders shall be equal to Wago 2002-1811 Series or approved equal.

PART 3 EXECUTION

3.01 GENERAL

- A. All equipment shall be mounted in control consoles, cabinets, or enclosures so as to provide ready accessibility for equipment and termination. All cabinets and enclosures shall be located to provide working clearance in front of accessible equipment as required by the National Electrical Code.
- B. Provide grounding module in each control cabinet and secure to the building grounding system.
- C. Control Panel and Terminal Enclosure Fabrication
 - 1. Shop assemble enclosures and cabinets housing terminal blocks or electrical components.
 - 2. Wiring within enclosures shall be routed within snap-cover wireways.
 - 3. Provide knockouts on enclosures.
 - 4. Provide protective pocket inside front cover with schematic diagram, connection diagram and layout drawing of control wiring and components within enclosure.

3.02 CABINET SUPPORT INSTALLATION

- A. Install surface-mounted cabinets and panelboards with a minimum of four anchors. Provide additional blocking as required between studs to securely anchor the cabinet or panelboard where equipment is to be secured on top of gypsum board, plaster, or hollow masonry walls.
- B. Bridge studs top and bottom of cabinets and panelboards with channels to support flush-mounted cabinets and panelboards in stud walls.
- C. In exterior, wet, or damp locations use steel channel supports to stand cabinets and panelboards 1 inch off wall.

3.03 ELECTRICAL BOXES

- A. Provide electrical boxes as shown on the drawings, and as required for splices, taps, wire pulling, equipment connections and Code compliance.
- B. Locate and install all electrical boxes to allow access. No outlet shall be located where it will be obstructed by other equipment, piping, lockers, benches, counters, etc. Where box is installed in an inaccessible location, provide access doors prior to closing of building finishes. Locate and install boxes to allow access to them. Where installation is inaccessible, coordinate locations and provide 18 inch (450 mm) by 24 inch (600 mm) access doors.
- C. Locate and install electrical boxes to maintain headroom and to present a neat mechanical appearance.
- D. Do not install boxes back-to-back in walls; provide at least 6 inch separation, except provide at least 24 inch separation in acoustic rated walls.
- E. Device Boxes: Recessed (1/4" maximum out from wall) outlet boxes in masonry, drywall, concrete or tile construction shall be masonry type; minimum 4 11/16 inch square with 4 11/16 inch square-cut device covers. Coordinate masonry cutting to achieve neat openings for boxes.
- F. Support boxes independently of conduit except for cast boxes that are connected to two rigid metal conduits, both supported within 12 inches (300 mm) of box.
- G. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.
- H. Locate boxes in masonry walls to require cutting corner only. Coordinate masonry cutting to achieve neat openings for boxes.
- I. Install boxes in walls without damaging wall insulation.

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- J. Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes.
- K. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.
- L. Align wall-mounted outlet boxes for intercoms, pushbutton, card readers, and similar devices.
- M. Boxes shall not be fastened to the metal roof deck.
- N. Provide cast outlet box in exterior locations, where exposed to the weather, and wet locations.
- O. Use hinged enclosure for pull or junction boxes larger than 12 inches in any dimension.
- P. Locate pull boxes and junction boxes above accessible ceilings or in unfinished areas.
- Q. Install boxes to preserve fire resistance rating of partitions and other elements, using approved materials and methods.

END OF SECTION

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SECTION 280513 LOW VOLTAGE WIRE AND CABLE

PART 1 GENERAL

1.01 SCOPE

- A. Applicable provisions of Division 1 shall govern all work under this Section.
- B. Section Includes:
 - 1. Low Voltage wire and cable.
 - 2. Wire connections and terminations.
- C. Related Sections: The General Low Voltage Requirements, Section 28 00 00, are part of this Section, and the contract for this work, and apply to this Section as fully as if repeated herein.
 - 1. Sealing around penetrations to maintain the integrity of time rated construction: See Div 10 Firestopping.
 - 2. General electrical requirements as related to multiple areas: Division 26.
 - 3. Conduits for cables and wiring
 - 4. Requirements for personal safety and to provide a low impedance path for possible ground fault currents
 - 5. Power conditioning on system controller boards and door controller boards shall meet minimum requirements: Division 26
 - 6. Requirements for Electronic Safety and Security IP Based Communication Conductors and Cabling: Division 27.

1.02 SUBMITTALS

- A. Submit all product data listed below under the provisions of Division 1 and Section 28 00 00.
- B. Indicate on shop drawings, shop fabricated enclosures and cabinets; include wire schedule, wiring schematic diagram, wiring functional diagram, outline drawing and construction diagram.
- C. Product Data: Provide product data for wire, cable, terminations, and splice kits.

1.03 REGULATORY REQUIREMENTS

- A. Materials shall be UL listed and labeled.

PART 2 PRODUCTS

2.01 GENERAL

- A. Cables and conductors furnished shall be of the type and size as recommended by the equipment manufacturers to support the requirements of the systems, including signal transmission properties.
- B. Conductors for audio, video, data (other than data/telephone circuits) shall be shielded.

2.02 WIRE AND CABLE AND WIRING CONNECTIONS

- A. Manufacturers:
 - 1. #16 AWG and Larger: General Cable, Southwire, Triangle, or approved.
 - 2. #18 AWG and Smaller: West Penn/CDT, Belden, Windy City Wire, or approved.
- B. Building Wire: 600V and below, single conductor, type THW, THHN/THWN or XHHW insulation, rated 600 volts. Insulation shall be rated 75 degrees C unless stated otherwise in other parts of these specifications and drawings.
- C. Building Wire Larger Than 10 AWG: Stranded conductor.
- D. All conductors shall be copper.
- E. Control Cable for Class 1 Remote Control and Signal Circuits: Stranded copper conductor, 600 volt insulation, rated 75 degree C, individual conductors twisted together, and covered with a PVC jacket.
- F. Control Cable for Class 2 Remote Control and Signal Circuits: Copper conductor, 300 volt insulation, rated 75 degree C, individual conductors twisted together, and covered with a PVC jacket.
- G. Door control conductors shall be as follows:

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1. A single access control point will have four hard-wired (not wireless) devices; REX sensor (built into hardware), Door Position Switch, Lock Power, and Card Reader.
 2. In the case of a double-door access control point, there will be up to seven hard-wired (not wireless) devices; 2 REX sensors (built into hardware), 2 Door Position Switches, 2 Lock Power, and 1 Card Reader.
 3. Unless hardware manufacturer or distance dictates, cabling shall be:
 - a. 18-Guage/2-Conductor for Each Lock's Power
 - b. 18-Guage/4-Conductor for each Door Position Switch
 - c. 18-Guage/4-Conductor for each Request-to-Exit
 - d. 22-Guage/6-Conductor OAS for each Card Reader
 4. Unless otherwise specified in other sections of these specifications, line voltage wiring shall be as specified by the manufacturer, except the minimum size shall be not less than No. 12 AWG. Access Control wireless transmitters and/or "Extenders" are not permitted.
 5. Unless otherwise specified in other sections of these specifications, control wiring, either 12 or 24V DC, shall be as specified by the manufacturer, except the minimum size shall be not less than No. 14 AWG.
 6. Wiring shall be large enough so that the voltage drop under inrush conditions does not adversely affect operation of the supplied equipment or initiate a battery back-up power condition.
 7. Shall at minimum conform to the recommendations of the manufacturers of the communication and signal system. In the event that communication or signal wiring is related to other divisions and sections in this specification, whichever is greater shall be primary.
 8. All cable shall be UL listed.
 9. Cable shall be plenum-rated unless specifically designated.
 10. All exterior cable runs must have wiring rated for outside and/or underground.
 11. Multi-conductor cables shall be YELLOW in color and have the conductors color-coded.
 12. Individual cables may be used, and Composite cables are permitted.
 13. Interior Door 120V Locks: #14 AWG for devices 10A and less, otherwise #12 AWG.
 14. Exterior Gate 120V Locks: #10 AWG.
- H. CCTV power wiring shall be #16AWG.
- I. Video surveillance wiring shall be Cat6.
- J. Wiring Aesthetics and other notes
1. Conduit for security electronics system cabling shall not exceed 40% fill when installed to allow for future growth. Pull-string must be additionally available.
 2. Control wiring and low voltage power cable shall not be shared with network cable without written consent from the Owner's Representative. Otherwise, security electronics system cabling shall have its own, exclusive conduit.
 3. Wiring is to remain out of sight. If not inside of walls, wiring must be inside of conduit, Panduit, and/or wire molding.
 4. Spaces with Open Ceilings: Cable from Device location points must be inside of walls or in conduit to a minimum of 12 feet from the floor. Conduit may use J-Hooks or ran along ceiling beams in such a way that it is out of field of view.
 5. If wiring is to be secured to a permanent fixture of a building; i.e. rafters or beams, then a minimum of 2-inch of slack must be present at all points. "Tie-Wrapping" wiring to I-Beams without 2-Inch of gap is prohibited and must not be secured tightly.

PART 3 EXECUTION

3.01 WIRING

- A. Conductors shall be color coded to indicate function. Color coding shall be consistent throughout the project.
- B. Use no wire smaller than 14 AWG for control wiring greater than 60 volts and 16 AWG for control wiring voltages less than 60 volts.
- C. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- D. Install wire in raceway after the interior of the building has been physically protected from weather and construction work which is likely to injure conductors has been completed.
- E. Control cabling shall not be spliced except as approved by the Owner's Representative.

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- F. All circuits shall be labeled to indicate field device location, headend panel termination location, and circuit type within each junction box, pull box, wireway or auxiliary gutter, each field device, panel, switch, or conductor termination.
- G. All wall and floor penetrations shall be sleeved and fire stopped where required.
- H. All cabling not in conduit shall be self-supported with J-Hooks either from the wall or with self-supported hanger wire. Cable tray is permitted, but is not to be shared with IT/Network/AV cable
- I. All vertical and horizontal pathways shall be 12 inches away from any voice/data cabling unless there is no other option.

3.02 FIELD QUALITY CONTROL

- A. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections; reconnect as required.

3.03 ADJUSTING

- A. Mark all conductors with the panel and circuit number serving the device, at the device.

END OF SECTION

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SECTION 280520 LOW VOLTAGE DEVICES

PART 1 GENERAL

SUMMARY

2.01 APPLICABLE PROVISIONS OF DIVISION 1 SHALL GOVERN ALL WORK UNDER THIS SECTION.

2.02 SECTION INCLUDES:

- A. Duress Alarm Devices.
- B. Door Control Pushbuttons.
- C. Intercom Phone Station.
- D. Autodialer System.

2.03 RELATED SECTIONS:

- A. The Basic Low Voltage Requirements, Section 28 00 00, are part of this Section, and the contract for this work, and apply to this Section as fully as if repeated herein.

SUBMITTALS

3.01 SUBMIT PRODUCT DATA UNDER PROVISIONS OF SECTION 28 00 00 AND DIVISION 1.

3.02 INCLUDE DIMENSIONED SHOP DRAWINGS AND WIRING DIAGRAMS.

3.03 PRODUCT DATA: PROVIDE DIMENSIONS, RATINGS, PERFORMANCE DATA, LAMP DATA, WEIGHTS AND ACCESSORY INFORMATION FOR EACH TYPE.

REGULATORY REQUIREMENTS

4.01 DEVICES SHALL BE ASSEMBLED OF UL LISTED MATERIALS.

EXTRA MATERIALS

5.01 PROVIDE MAINTENANCE MATERIALS UNDER PROVISIONS OF DIVISION 1 – OPERATION AND MAINTENANCE DATA.

5.02 PROVIDE A MINIMUM OF:

- A. (1) duress push button

PART 2 PRODUCTS

6.01 FIELD DEVICES

6.02 DURESS ALARM DEVICES

- A. Alarm devices, under counter mounted, shall consist of 2 pair #22 AWG stranded copper cable with a GRI GR3045 series lever duress device, normally closed. Install the mounted duress device as detailed on the plans. Provide all wire hangers, raceway and concealment to adequately hang and conceal cable after final installation of device.

6.03 DOOR RELEASE BUTTON

- A. Door release pushbuttons at reception desk locations shall consist of 10 feet of 2 pair #22 AWG stranded copper cable with a Potter # HUB-M normally open, custom mounted pushbutton installed on one end and a 4-conductor modular plug installed on the other end to match the wall jack specified below. Leave with modular plug inserted and cable coiled on the floor adjacent to the outlet until furniture is installed. After installation of furniture, install the custom mounted pushbutton in the manner directed by the Architect. Provide all wire hangers, raceway and concealment to adequately hang and conceal loose cable after final installation of push button. Provide with non-latching cap to allow for momentary contact. Potter Electrical Signal Company or approved equal.
- B. Outlets for alarm pushbuttons located in office areas shall consist of a screw terminal, flush mounted, 4 conductor modular wall jack, Leviton type 630A, Catalog # 40257-I.

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6.04 INTERCOM PHONE STATION

- A. To be Viking E40 series entry phone station with push to call button or approved equal. To connect back to Autodialer.

6.05 AUTODIALER SYSTEM

- A. To be Viking Entry Phone Controller C-200 or approved equal. Coordinate with County IT during installation and setup for phone line and autodial number information.

PART 3 EXECUTION

INSTALLATION OF LOW VOLTAGE ELECTRONICS SYSTEMS

8.01 INSTALL ALL DEVICES FLUSH AND LEVEL.

8.02 MOUNTING LOCATIONS FOR ALL DEVICES SHALL BE AS SHOWN ON THE DRAWINGS.

8.03 MOUNT PROXIMITY READERS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

END OF SECTION

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SECTION 280526 LOW VOLTAGE GROUNDING AND BONDING

PART 1 GENERAL

1.01 SCOPE

- A. Applicable provisions of Division 1 shall govern all work under this Section.
- B. Section Includes:
 - 1. Grounding electrodes and conductors, equipment grounding conductors and bonding.
- C. Related Sections:
 - 1. The basic Electrical Requirements, Section 28 00 00, are part of this Section, and the contract for this work, and apply to this Section as fully as if repeated herein.
 - 2. Division 26 – Electrical (For additional Grounding and Bonding Requirements not indicated herein. In any instance of deviation between this Specification Section and the Div 26 Specification Sections, the more stringent requirement shall apply.)
- D. References
 - 1. ANSI/NFPA 70 - National Electrical Code.
 - 2. IEEE/ANSI 142-Latest edition - Recommended Practice for Grounding of Industrial and Commercial Power System.

1.02 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: 2 ohms.

1.03 SUBMITTALS FOR APPROVAL

- A. Submit all product data listed below under the provisions of Division 1 and Section 28 00 00.
- B. Product Data: Provide data for grounding electrodes and connections.

1.04 CLOSEOUT SUBMITTALS

- A. Submit all product data listed below under the provisions of Division 1 and Section 28 00 00.
- B. Test Reports: Indicate overall resistance to ground and resistance of each electrode.
- C. Accurately record actual locations of grounding electrodes.

1.05 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.06 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- B. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Thompson Lightning Protection, Burndy, Crouse-Hinds, B-Line Systems, Harger Lightning Protection, or approved equal.

2.02 CONNECTORS

- A. Mechanical Connectors:
 - 1. The mechanical connector bodies shall be manufactured from high strength, high conductivity cast copper alloy material. Bolts, nuts, washers and lock washers shall be made of Silicon Bronze and supplied as a part of the connector body and shall be of the two-bolt type.
 - 2. Split bolt connector types are NOT allowed.

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3. The connectors shall meet or exceed UL 467 and be clearly marked with the catalog number, conductor size and manufacturer.
- B. Compression Connectors:
 1. The compression connectors shall be manufactured from pure wrought copper. The conductivity of this material shall be no less than 99% by IACS standards.
 2. The connectors shall meet or exceed the performance requirements of IEEE 837, latest revision.
 3. The installation of the connectors shall be made with a compression, tool and die system, as recommended by the manufacturer of the connectors.
 4. The connectors shall be clearly marked with the manufacturer, catalog number, conductor size and the required compression tool settings.
 5. Each connector shall be factory filled with an oxide-inhibiting compound.

2.03 WIRE

- A. General: Aluminum wire or conductors are not permitted.
- B. Equipment Grounding Conductor: Stranded copper wire, size as shown on the drawings, specifications or as required by NFPA 70, whichever is larger. Minimum size shall be #6 AWG.

2.04 GROUND BUS

- A. Ground Bus by Telecommunication Contractor, refer to Div 27.

PART 3 EXECUTION

3.01 GENERAL

- A. Install Products in accordance with manufacturer's instructions.
- B. Mechanical connections shall be accessible for inspection and checking. No insulation shall be installed over mechanical ground connections.
- C. Ground connection surfaces shall be cleaned and all connections shall be made so that it is impossible to move them.
- D. Attach grounds permanently before equipment is energized.
- E. Provide bonding to meet Regulatory Requirements.
- F. Provide #12 AWG ground conductor in all conduit to exterior doors and doors located in damp or wet locations, specifically shower units and toilet facilities. Bond ground conductor to door frame.
- G. All separate ground wires shall be enclosed in rigid galvanized steel conduit and bonded at both ends to the rigid galvanized steel conduit with an approved fitting.

3.02 EQUIPMENT RACK AND WALL MOUNTED ENCLOSURE GROUNDING

- A. Use minimum no. 6 AWG copper conductor, or larger as indicated on the plans, for low voltage systems grounding conductor.

3.03 WIREWAY GROUNDING

- A. Use minimum no. 6 AWG copper conductor, or larger as indicated on the plans, for wireway grounding conductor.
- B. Provide continuity between wireway components. Use antioxidant compound to prepare aluminum contact surfaces before assembly. Provide copper equipment grounding conductor through entire length of wireway; bond to each component. Connections to wireway may be made using clamps specifically manufactured for the purpose.
- C. Provide system grounding to ground bus located in the data/telephone equipment room.

3.04 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

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- B. Use suitable test instrument to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method. Measure ground resistance from system neutral connection at service entrance to convenient ground reference point using suitable ground testing equipment. Resistance shall not exceed 2 ohms.

END OF SECTION

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SECTION 280528 LOW VOLTAGE SECURITY CONDUIT

PART 1 GENERAL

1.01 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.
- C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

1.02 SCOPE

- A. Applicable provisions of Division 1 shall govern all work under this Section.
- B. Section Includes:
 - 1. Metal conduit.
 - 2. Flexible metal conduit.
 - 3. Liquidtight flexible metal conduit.
 - 4. Electrical metallic tubing.
 - 5. Fittings and conduit bodies.
- C. Related Sections:
 - 1. The General Low Voltage Requirements, Section 28 00 00, are part of this Section, and the contract for this work, and apply to this Section as fully as if repeated herein.
 - 2. Division 7 – Penetration Firestopping.
 - 3. Division 26 – Electrical (For additional Conduit Requirements not indicated herein. In any instance of deviation between this Specification Section and the Div 26 Specification Sections, the more stringent requirement shall apply.)

1.03 SUBMITTALS

- A. Submit all product data listed below under the provisions of Division 1 and Section 28 00 00.
- B. Product Data - Conduit: Provide data for metallic conduit, flexible metal conduit, liquidtight flexible metal conduit, metallic tubing, nonmetallic conduit, flexible non-metallic conduit, nonmetallic tubing, fittings, and conduit bodies.
- C. Product Data - Fire Sealants: Contractor shall submit product data for each firestop system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgment can be based upon.

1.04 REGULATORY REQUIREMENTS

- A. Products shall be UL listed and labeled.

PART 2 PRODUCTS

2.01 RIGID METAL CONDUIT AND FITTINGS

- A. Manufacturers: Allied Tube and Conduit, LTV, Triangle PWC, Western Tube and Conduit, or equal.
- B. Conduit: Heavy wall, galvanized steel, schedule 40, threaded.
- C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; Threaded galvanized or cadmium plated steel fittings. Bushings shall have nylon insulated throats.
- D. Rigid Steel Conduit (RGS): ANSI C80.1.
- E. Intermediate Metal Conduit (IMC): Rigid steel.

2.02 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

- A. Manufacturers: Allied Tube and Conduit, LTV, Triangle PWC, or equal.
- B. Description: ANSI C80.3; galvanized tubing.

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- C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel, rain tight compression type with nylon insulated throats on connectors. All steel threaded conduit bodies.

2.03 FLEXIBLE METAL CONDUIT AND FITTINGS

- A. Manufacturers: AFC, Anamet, Triangle PWC, or equal.
- B. Description: Flexible, interlocked, galvanized steel construction, spiral strip.
- C. Fittings and Conduit Bodies: ANSI/NEMA FB 1. All steel, galvanized, clamp type. Specifically designed for the purpose.

2.04 LIQUIDTIGHT FLEXIBLE METAL CONDUIT AND FITTINGS

- A. Manufacturers: AFC, Anamet, Electriflex, Alflex, or equal.
- B. Conduit: Flexible, interlocked, galvanized steel, spiral strip with an outer liquidtight, nonmetallic, sunlight-resistant jacket.
- C. Fittings and Conduit Bodies: ANSI/NEMA FB 1, compression type. There shall be a metallic cover/insert on the end of the conduit inside the connector housing to seal the cut conduit end.

2.05 CONDUIT SUPPORTS

- A. See Section 28 05 29

2.06 GENERAL

- A. All steel fittings and conduit bodies shall be galvanized.
- B. No cast metal, split, or gland type fittings permitted.
- C. All conduit covers must be fastened to the conduit body with screws and be of the same manufacture.

2.07 SEALING AND FIRESTOPPING

- A. Fire and/or Smoke Rated Penetrations:
- B. Refer to Div 7 Penetration Firestopping.
- C. Non-Rated Penetrations:
- D. Conduit Penetrations Through Below Grade Walls: In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated conduit and the cored opening or a water-stop type wall sleeve.
- E. Conduit and Cable Tray Penetrations: At conduit and cable tray penetrations of non-rated interior partitions, floors and exterior walls above grade, use urethane caulk in annular space between conduit and sleeve, or the core drilled opening.

PART 3 EXECUTION

3.01 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

- A. EMT is permitted to be used in sizes 4" (100 mm) and smaller for security electronics systems.
- B. Size power conductor raceways for conductor type installed or for Type THW conductors, whichever results in larger conduit. Conduit size shall be 3/4 inch (19 mm) minimum except as specified elsewhere or with specific Engineer's approval for each application. Conduit for all other wiring, including but not limited to data, control, security, telecommunications, signal, video, etc. shall be sized per number of conductors pulled and their cross-section. 40% fill shall be maximum for all new conduit fills.
 - 1. Conductors for multiple field devices or outlets of the same system may be combined or aggregated into a larger branch run or homerun conduit. Where the conduit contains wiring for more than one field device or outlet of the same system, the 40% maximum cable fill shall be maintained.
 - 2. Conductors of different systems shall not be routed within the same conduit.
- C. Arrange conduit to maintain headroom and present a neat appearance.
- D. Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.
- E. Maintain minimum 6 inch (150 mm) clearance between conduit and piping. Maintain 12 inch (300 mm) clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.

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- F. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized pipe straps, conduit racks (lay-in adjustable hangers), clevis hangers, or bolted split stamped galvanized hangers.
- G. Group conduit in parallel runs where practical and use conduit rack (lay-in adjustable hangers) constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.
- H. Do not fasten conduit with wire or perforated pipe straps. Before conductors are pulled, remove all wire used for temporary conduit support during construction.
- I. Support and fasten metal conduit at a maximum of 8 feet (2.4 m) on center.
- J. Support and fasten PVC conduit as follows:
 - 1. Maximum spacing between supports
 - 2. Feet(meters)
 - 3. 3(0.9)
 - 4. 5(1.5)
 - 5. 6(1.8)
 - 6. 7(2.1)
- K. Supports shall be independent of the installations of other trades, e.g. ceiling support wires, HVAC pipes, etc., unless so approved or detailed.
- L. In general, all conduit shall be concealed. Contractor shall verify with Architect/Engineer all surface conduit installations except in mechanical rooms.
- M. Changes in direction shall be made with symmetrical bends, cast steel boxes, stamped metal boxes or cast steel conduit bodies.
- N. No continuous conduit run shall exceed 100 feet (30 meters) without a junction box.

3.02 CONDUIT INSTALLATION

- A. Branch circuit home runs may be grouped, and the actual routing of branch circuit conduits may be determined at the site and properly entered on the "As-Built" drawings.
- B. Cut conduit square using a saw or pipe cutter; de-burr cut ends.
- C. Conduit shall not be fastened to the corrugated metal roof deck.
- D. Bring conduit to the shoulder of fittings and couplings and fasten securely.
- E. Use conduit hubs for fastening conduit to cast boxes. Use sealing locknuts or conduit hubs for fastening conduit to sheet metal boxes in damp or wet locations. (Sheet metal boxes larger than 4 & 11/16th" square shall contain NO pre-punched or concentric knockouts)
- F. All conduit terminations (except for terminations into conduit bodies) shall use insulated throat connectors or conduit hubs with one locknut or shall use double locknuts (one each side of box wall) and insulating bushing. Provide bushings for the ends of all conduit not terminated in box walls. Refer to Div 26 - Grounding and Bonding for grounding bushing requirements. Ground and bond conduit under provisions of Div 26.
- G. Install no more than the equivalent of three 90 degree bends between boxes.
- H. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2 inch (50 mm) size unless sweep elbows are required.
- I. Conduit shall be bent according to manufacturer's recommendations. Torches or open flame shall not be used to aid in bend of PVC conduit.
- J. Use suitable conduit caps or other approved seals to protect installed conduit against entrance of dirt and moisture.
- K. Provide 1/8 inch (3 mm) nylon pull string in empty conduit, except sleeves and nipples.
- L. Install expansion-deflection joints where conduit crosses building expansion joints. Note: expansion-deflection joints are not required where conduit crosses building control joints if the control joint does not act as an expansion joint. Install expansion fitting in PVC conduit runs as recommended by the manufacturer.

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- M. Avoid moisture traps where possible. Where moisture traps are unavoidable, provide junction boxes with drain fittings at conduit low points.
- N. Where conduit passes between areas of differing temperatures such as into or out of cool rooms, freezers, unheated and heated spaces, buildings, etc., provide Listed conduit seals to prevent the passage of moisture and water vapor through the conduit.
- O. PVC elbows are allowed in PVC conduit runs 4" and smaller. Note: PVC conduit must transition to galvanized rigid metal conduit before it runs up through a concrete floor.
- P. All conduit installed underground (exterior to the building) shall be buried a minimum of 24" below finished grade, whether or not the conduit is concrete encased. The exception where subjected to vehicular traffic (to include road right-of-way) the minimum cover shall be thirty (30) inches. Control and communications conduit may be buried in the same trench as power, if separated by a minimum of three (3) inches of concrete or twelve (12) inches of dirt.

3.03 CONDUIT PENETRATIONS

- A. Provide sleeves for each conduit that passes through concrete walls or suspended slabs. Sleeves in concrete beams, joists, columns or footing walls may be installed only where permitted by the Architect. For conduit that passes through suspended concrete slabs, place sleeves with the top two inches above finished slab and the bottom flush with underside of slab. In all other cases, place sleeves with the ends flush with the concrete surfaces. Space sleeves at least three diameters apart on center.
- B. Where conduit penetrates roof, route conduit through openings for piping and duct-work where possible; otherwise, route through roof jack with pitch pocket. The neck of the flashing and the conduit shall be sealed with waterproofing compound as recommended by the manufacturer of the assembly.
- C. Pipe sleeves for conduits 6" in diameter and smaller, in new poured concrete construction, shall be schedule 40 steel pipe, plastic removable sleeve or sheet metal sleeve, all cast in place.
- D. In wet area floor penetrations, top of sleeve to be 2 inches above the adjacent floor. In existing wet area floor penetrations, core drill sleeve openings large enough to insert schedule 40 sleeve and grout the area around the sleeve. If the pipe penetrating the sleeve is supported by a pipe clamp resting on the sleeve, weld a collar or struts to the sleeve that will transfer weight to the existing floor structure. Wet areas for this paragraph are rooms or spaces containing air handling unit coils, converters, pumps, chillers, boilers, and similar waterside equipment. Pipe penetrations in existing concrete floors that are not in wet areas may omit the use of schedule 40 sleeve and use the core drilled opening as the sleeve.
- E. Conduit penetrations through basement exterior concrete walls shall be core-drilled and a modular mechanical type sealing closure shall be installed between the conduit and the concrete wall cut-out. Cut-outs and installation of the sealing closure shall be in accordance with the manufacturer's instructions.
- F. Fire and/or Smoke Penetrations:
 - 1. Install approved product in accordance with the manufacturer's instructions where a pipe (i.e. cable tray, bus, cable bus, conduit, wireway, trough, etc.) penetrates a fire rated surface.
 - 2. Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Firestop mortar alone is not adequate to support any substantial weight.
- G. Non-Rated Surfaces:
 - 1. When the opening is through a non-fire rated wall, floor, ceiling or roof the opening must be sealed using an approved type of material.
 - 2. Use galvanized sheet metal sleeves in hollow wall penetrations to provide a backing for the sealant. Grout area around sleeve in masonry construction.
 - 3. Install escutcheons or floor/ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces for this paragraph include only those rooms with finished ceilings and the penetration occurs below the ceiling.
 - 4. In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the conduit and tighten in place, in accordance with the manufacturer's instructions.

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5. At interior partitions, conduit penetrations are required to be sealed for all clean rooms, laboratories, hospital spaces, computer rooms, dormitory rooms, tele/data/com rooms and similar spaces where the room pressure or odor transmission must be controlled. Apply sealant to both sides of the penetration in such a manner that the annular space between the conduit sleeve and the conduit is completely filled.

END OF SECTION

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SECTION 280529 LOW VOLTAGE SUPPORTING DEVICES

PART 1 GENERAL

1.01 SCOPE

- A. Applicable provisions of Division 1 shall govern all work under this Section.
- B. Section Includes:
 - 1. Conduit and equipment supports.
 - 2. Anchors and fasteners.
- C. Related Sections:
 - 1. The basic Electrical Requirements, Section 28 00 00, are part of this Section, and the contract for this work, and apply to this Section as fully as if repeated herein.
 - 2. Division 26 – Electrical (For additional Supporting Device Requirements not indicated herein. In any instance of deviation between this Specification Section and the Div 26 Specification Sections, the more stringent requirement shall apply.)

1.02 SUBMITTALS FOR APPROVAL

- A. Submit all product data listed below under the provisions of Division 1 and Section 28 00 00.
- B. Product Data: Provide manufacturer's catalog data for fastening systems.
- C. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.03 CLOSEOUT SUBMITTALS

- A. Submit all product data listed below under the provisions of Division 1 and Section 28 00 00.
- B. Product Data: Provide manufacturer's catalog data for fastening systems.

1.04 REGULATORY REQUIREMENTS

- A. Products shall be UL listed and labeled

PART 2 PRODUCTS

2.01 MATERIAL

- A. Manufacturers: B-Line or approved equal.
- B. Support Channel: Galvanized.
- C. Hardware: Corrosion resistant.
- D. Spring Hangers: Spring hangers for conduits 1 1/2" and less shall be B-Line B3262 series. Spring Hangers for conduits 2" and greater shall be spring cushion hangers, B-Line B3264 series. Spring hangers for equipment shall be in accordance with the table below:

	Rod Size	B-Line Number
Less than 100lbs	3/8"	B3262-3/8
Less than 150lbs	1/2"	B3262-1/2
Less than 275lbs	5/8"	B3262-5/8
Less than 400lbs	3/4"	B3262-3/4

PART 3 EXECUTION

3.01 GENERAL INSTALLATION

- A. Design supports to carry weight of equipment and conduit, including wiring.
- B. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors, or beam clamps.
- C. File and de-burr cut ends of support channel and spray paint with cold galvanized paint to prevent rusting.

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- D. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.
- E. Do not fasten supports to piping, ductwork, mechanical equipment, cable tray or conduit.
- F. Do not use powder-actuated or plastic anchors.
- G. Do not drill structural steel members unless approved by the Architect.
- H. Fabricate supports from galvanized structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
- I. In wet locations, mechanical rooms and electrical rooms install free-standing electrical equipment on four (4) inch (100 mm) concrete pads.
- J. Furnish and install all supports as required to fasten all electrical components required for the project, including free standing supports required for those items remotely mounted from the building structure, catwalks, walkways etc.
- K. Minimum sized threaded rod for supports shall be 3/8".

3.02 BOX SUPPORT INSTALLATION

- A. Support boxes independently of raceway.

3.03 CONDUIT SUPPORT INSTALLATION

- A. Arrange conduit supports to minimize movement during wire pulling operations. Fasten conduits using galvanized straps, lay-in adjustable hangers, clevis hangers, or bolted split stamped galvanized hangers.
- B. Use conduit rack constructed of steel channel with conduit straps or clamps for parallel conduit installations. Provide space for 25 percent additional conduits.
- C. Do not fasten conduit with wire or perforated pipe straps. Remove wire used for temporary conduit support during construction, before conductors are pulled.
- D. Conduit clamps, straps, supports, etc., shall be steel or malleable iron. All straps shall have steel or malleable backing plates.
- E. Provide spring hanger supports for all conduits and equipment supported from the ceiling in areas where vibration isolation is required. Reference the architectural drawings for locations.

3.04 CONTROL PANEL AND CABINET SUPPORT INSTALLATION

- A. Install surface-mounted cabinets and control panels with a minimum of four anchors. Provide additional blocking as required between studs to securely anchor the cabinet or control panels where equipment is to be secured on top of gypsum board, plaster, or hollow masonry walls.
- B. Bridge studs top and bottom of cabinets and control panels with channels to support flush-mounted cabinets and control panels in stud walls.
- C. In exterior, wet, or damp locations use steel channel supports to stand cabinets and control panels 1 inch off wall.
- D. Mounting at Perimeter Fence:
 - 1. Where control equipment is mounted on a perimeter fence line, use steel channel supports mounted to perimeter fence pole. Control equipment shall not be mounted to the fence fabric.
 - 2. Where control equipment is mounted off of the perimeter fence, provide concrete pad and built up channel support assembly to provide a pedestal mounting.
- E. Intercom stations mounted at vehicle or man gates may be mounted with steel channel supports bolted to the fence fabric. Provide steel channel supports every 36" for conduit support.

END OF SECTION

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SECTION 280553 LOW VOLTAGE IDENTIFICATION

PART 1 GENERAL

1.01 SCOPE

- A. Applicable provisions of Division 1 shall govern all work under this Section.
- B. Section Includes:
 - 1. Nameplates and labels.
 - 2. Wire and cable markers.
 - 3. Wire and cable
- C. Related Sections: The basic Electrical Requirements, Section 28 00 00, are part of this Section, and the contract for this work, and apply to this Section as fully as if repeated herein.

1.02 SUBMITTALS

- A. Submit all product data listed below under the provisions of Division 1 and Section 28 00 00.
- B. Include schedule for nameplates and stenciling.
- C. Include color coding schedule for all wiring.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Labels: All labels shall be permanent, and be machine generated. NO HANDWRITTEN OR NON-PERMANENT LABELS SHALL BE ALLOWED.
- B. Label size shall be appropriate for the conductor or cable size(s). All labels to be used shall be self-laminating, white/transparent vinyl and go all the way around the cable or sheath. Flag type labels are not allowed. The labels shall be of adequate size to accommodate the circumference of the cable being labeled.
- C. All wiring is to be clearly identified at each end. Use heat shrink labels with type print that will maintain their integrity throughout the life expectancy of the wiring itself. Every conductor shall be labeled and cross referenced to the as-built drawings and specifications.
- D. Nameplates: Engraved three-layer laminated plastic, white letters on a black background. Emergency system shall use white letters on red background.
- E. Stenciling: Black paint. Emergency system stenciling shall use red paint.
- F. Adhesive type labels not permitted.

PART 3 EXECUTION

3.01 GENERAL

- A. Clean all surfaces before attaching labels with the label manufacturer's recommended cleaning agent.
- B. Install all labels firmly as recommended by the label manufacturer.
- C. Labels attached to data or communication patch panels and face plates shall be installed plumb and neatly on all equipment.
- D. Install nameplates parallel to equipment lines.
- E. Secure nameplates to equipment fronts using screws, or rivets. Secure nameplate to inside of recessed panelboards in finished locations.
- F. Embossed tape will not be permitted for any application.
- G. Stenciling may only be used on equipment fronts in areas designated by the Architect/Engineer.

3.02 CONTROL WIRE IDENTIFICATION

- A. Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identify with control equipment number, input/output number, or with control wire number as indicated on schematic and interconnection diagrams, and equipment manufacturer's shop

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drawings for control wiring.

3.03 NAMEPLATE ENGRAVING AND STENCILING

- A. Provide nameplates or stencils to identify all control equipment, and field devices served. Letter Height: 1/4 inch (6 mm) for individual switches and loads served, 1 inch (25 mm) for control equipment identification.

END OF SECTION

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SECTION 282300 DIGITAL VIDEO SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Applicable provisions of Division 1 shall govern all work under this Section.
- B. Video management system including the following as applicable:
 - 1. Digital video viewing and recording management and network software.
 - 2. Network IP fixed cameras.

1.02 RELATED SECTIONS

- A. Section 26 00 00 - Electrical.

1.03 REFERENCES

- A. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. Certifications: CE, FCC Class A, IK7, IK10, IP66, ISO, NEMA4, ONVIF, PSIA, RoHS 2, UL, and cUL, NEMA 4.
- C. Institute of Electrical and Electronics Engineers (IEEE): IEEE 1100 Recommended Practice for Powering and Grounding Electronic Equipment.
- D. National Fire Protection Association (NFPA):
 - 1. NFPA 70 2005 National Electrical Code.
 - 2. NFPA 72 National Fire Alarm Code.
 - 3. NFPA 80 Fire Doors and Windows, 2007 Edition.
 - 4. NFPA 101 Life Safety Code, 2009 Edition.
- E. International Organization for Standardization (ISO): ISO 7816 Smart Card Standard.

1.04 SUBMITTALS

- A. Submit all product data listed below under the provisions of Division 1 and Section 28 00 00.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings: See Division 1 and Section 28 00 00. Also provide schematic of system components with physical space requirements. All shop drawings are to include indication of coordination with other trades to ensure that no equipment interferes with camera installation locations and views. Any camera that the owner or owner's representative determines necessary to be relocated due to interference with other equipment is the sole responsibility of the Contractor and the Contractor will bear all cost to relocate camera to a location acceptable to the owner.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 5 year experience manufacturing similar products.
- B. Installer Qualifications: Minimum 2 year experience installing similar products.

1.06 PRE-INSTALLATION MEETINGS

- A. Convene minimum two weeks prior to starting work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.
- B. Handle materials to avoid damage.

1.08 PROJECT CONDITIONS

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

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1.09 SEQUENCING

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.10 REFERENCE STANDARDS

- A. IEEE 1100 - IEEE Recommended Practice for Powering and Grounding Electronic Equipment; 2005.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.
- D. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.
- E. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer: Avigilon and Verkada, based on Mesa County Court Building's existing video surveillance and recording solutions. Refer to plans for locations of devices and systems.

2.02 VIDEO MANAGEMENT SYSTEMS

- A. General:
 - 1. All equipment and materials used shall be standard components, regularly manufactured, regularly utilized in the manufacturer's system.
 - 2. All systems and components shall have been thoroughly tested and proven in actual use.
 - 3. All systems and components shall be provided with the availability of a toll free 24-hour immediate technical assistance for either the dealer/installer at no charge.
 - 4. All systems and components shall be provided with an explicit two year manufacturer warranty.
- B. Common Features for Digital Video System Computers. All stationary computers shall have the following common features:
 - 1. GHz Intel Core i7 processor, minimum.
 - 2. 12 GB RAM capacity (minimum).
 - 3. Configured with a minimum of 8 GB of RAM. Provide additional RAM as necessary to optimize system performance.
 - 4. Minimum 1 TB SATA 3 Solid State Drive (SSD).
 - 5. Internal DVD RW/DVD+R/CD-RW Double Layer Drive.
 - 6. Energy Star qualified
 - 7. Furnished with a monitor, keyboard, and mouse. The mouse shall have the following characteristics.
 - a. Optical technology.
 - b. Scroll wheel.
 - c. Ergonomic configuration to fit either right- or left-handed users.
 - 8. Furnished with communications, video, and audio cards as required.
 - a. Configured with LAN communications card and LAN terminal software.
 - b. Network Interface Card to be Gigabit Network Adapter by Intel or approved equal.
 - 9. Mouse/keyboard ports and front and rear USB ports.
 - 10. Shall include video card(s) capable of displaying high quality motion video. The video card shall meet the following criteria:
 - a. 8 GB
 - b. 192 GB/Sec.
 - c. 192 bit.
 - d. Shall be Nvidia GTX series, similar product by GeForce or AMD, or approved equal.
 - e. The requirements defined here shall be considered a minimum.
 - 1) The Viewing Station(s) shall have all the required hardware and software as recommended by the Manufacturer of the video I/P system.
 - (a) Coordinate all final viewing and recording authorization with owner prior to final implementation.

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- C. The Network Video Recorder (NVR) shall have all the required hardware and software as recommended by the Manufacturer of the video I/P system and adequate storage capacity to accommodate digital video recording requirements. The digital video recording requirements are as follows:
 - 1. The digital video storage retention for all cameras is 45 days.
 - 2. All cameras are to be recorded at 10 frames per second and full resolution.
 - 3. Only recorded video assigned to the respective viewing station(s) can be extracted from the respective viewing station(s) to an external media recording device (DVD, CD, thumb drive, etc.).
- D. Desktop computers. In addition to the common features, desk-top computers shall include the following features:
 - 1. Tower chassis. Chassis shall be no larger than 8 inches W x 16 inches D x 16 inches H.
 - 2. Shall be manufactured by Dell, HP, Compaq, or approved equal.
- E. Rack-Mounted Computers. In addition to the common features, rack-mounted computers shall include the following features:
 - 1. Rack-mounted chassis. Standard 19" EIA rack.
 - 2. Vibration protection drive mounting.
 - 3. Shall be manufactured by Dell, HP, Compaq, or approved equal.
- F. Rack-Mounted Server. In addition to the common features, rack-mounted servers shall include the following features:
 - 1. All of the features of a rack mounted computer.
 - 2. All of the features of a free-standing server.
 - 3. Shall be manufactured by Dell, HP, Compaq, or approved equal.
- G. Operating System for all computers:
 - 1. Latest version of Microsoft Windows or approved equal.
- H. Operating System for all servers:
 - 1. Latest version of Microsoft Windows Server or approved equal.
- I. Anti-virus software
 - 1. Shall be compatible with all applicable software.
 - 2. Shall be AVG, similar product by McAfee or Norton, or approved equal.
- J. Intrusion Detection/ Intrusion Prevention (IDS/IPS) software
 - 1. Shall be compatible with all applicable software.
 - 2. Shall be SNORT, similar product by McAfee or Norton, or approved equal.
- K. Desk Monitor - 24 inch.
 - 1. 24 inch LED color screen, non-glare.
 - 2. Color: Black or dark gray.
 - 3. Resolution: 1920 dots horizontal x 1080 dots vertical minimum.
 - 4. Compatible with the computer.
 - 5. Contrast Ratio: 3,000:1 typical.
 - 6. Horizontal viewing angle: 170 degrees
 - 7. Vertical viewing angle: 170 degrees
 - 8. Brightness: 225 nits minimum
 - 9. Weight: Less than 20 pounds
 - 10. Mounting: Mounts on a 100 mm x 100mm VESA mount.
 - a. Mount to Dispatch console monitor arms
 - b. Coordinate with Dispatch furniture provider for monitor arms
 - 11. Options for VESA 75 x 75, 100 x 100, 100 x 200, and 200 x 200
 - 12. Monitor shall be by Dell, Viewsonic, or approved equal.
- L. When video monitors are shown more than 25 feet from the computer, provide a DVI Extender for the monitor signal.
 - 1. Shall allow the extension of DVI video signals up to 100 meters from the source using Category 6 cable.
 - 2. 1.65GHz
 - 3. 1920 x 1200 at 35 meters.
 - 4. Shall be DVI Extender by SmartVM, similar product by Altronix or Samsung, or approved equal.
- M. Digital Video System Network:
 - 1. Coordinate with Mesa County IT for network switch and other network requirements. Switches to match existing and be tied into existing video surveillance network.
 - 2. Contractor to configure and install switches for optimum Digital Video System performance.

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- N. Basis of Design for the Video Management System: Avigilon Control Center as manufactured by Avigilon
1. Application Servers: [match existing]
 2. Recording Servers: [match existing]
 3. Viewing Stations: [match existing]
 4. Wall mounted monitor: [match existing]
 5. Digital Video Recording Management and Network Software - General:
 - a. Video Management Software (VMS): Browser-based application meeting requirements of business and government surveillance applications.
 - 1) Web client with single point of management for entire system.
 - 2) Configuration Sections of Application: Add, configure and operate recording servers, application servers, web servers, as well as IP cameras and encoders (edge devices).
 - 3) Operation and Maintenance Application: Complete and comprehensive for video surveillance system.
 - 4) Full live digital video and audio surveillance over a standard 1 Gbps network.
 - b. True Open Standards (ONVIF) as Basis: Thin client architecture. Centrally licensed. COTS compatible software or available preloaded on a manufacturer certified application/web server or recording server (NVR).
 - c. Two License Tiers: Associated with number of edge devices and a specific feature set. Licensing shall be based on a per edge device basis.
 - d. Software Features: Easy to Use Tabs: Access configuration screen and dashboard monitoring systems health. Monitoring Screen: Video display area with available resources list. Multiple Display Views: Configurable with variety layouts. Multiple Monitors: Supported.
 - e. Live Video: Stream through Recording Server (NVR) with auto fail over to cameras. PTZ available from live video. Presets and tours are configurable. Digital zoom provided on video displays.
 - f. Export Icon: Easy access on display to save a video clip. Archived in MP4 format and authenticated in the player per the ONVIF spec.
 - g. Playback: Supported from main screen without leaving live video viewing area. Clicking Playback from time icon will allow selecting the playback to start from a specific date and time using standard calendar tools.
 - h. Software Delivery: Provided on manufacturer's website.
 - i. Events: Setup in configuration area. Pre-Event Recording: Supported and with event notification.
 - j. Enhanced Edge-based Analytics: Show bounding boxes around detected objects in live and playback video.
 - k. User Groups: Configurable and listed in the Resources list on the monitoring display screen. Viewable by hierarchy or as a flat list.
 - l. Video Masking: Available centrally through the VMS. Allow users with the correct authority to unmask video as needed using icon on the display screen. Unmask feature available on live and playback video.
 - m. Quick Configuration Wizard: Streamlined process for typical and basic system setup with minimal input required.
 - n. Search Functions: Three search functions available including museum search, thumbnail search, and events framework search.
 - o. Capability for 360-degree lens dewarp available for use with cameras with fisheye lenses.
 - p. Integration with Active Directory (AD): Allow user management via the AD.
 - q. Override mode: Allows operating in case AD communication is lost.
 - r. Multi-language Support: Supports English, Spanish, French, Italian, Bulgarian, Greek, and Arabic. All text in the user interface translated to selected language.
 - s. Backup and Restore for system settings available.
 - t. Central Software Upgrade Interface: Provides the ability to upgrade the entire system by pushing the upgrade from the Application Server to all devices on the system.
 - u. System supports IPv4/IPv6 and HTTPS.
 6. Setup, Configuration and Security of VMS:
 - a. Multi-User Authorization Login Application.
 - 1) Offer levels of authorization based on functions.
 - 2) Setup Utility: Allows Administrator to configure additional users as well as user groups.
 - 3) User authorization: Configurable for specific system operations. Authorization Permission Setup: Performed using the User screen.
 - 4) Group rights: Available to configure from the User Groups screen. Permissions: Provide authority to perform all system functions.
 - 5) Users and groups on AD servers may be imported and become a group in the VMS.

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- 6) The software shall offer a full multi-user authorization process as follows: User Groups: Created once globally. Authorized and given specific permissions. Users: Created once globally and may be given rights to groups. No virtual limit on number of groups and users authorized in the software. Groups to be authorized or denied access to: Monitoring screen for video display. Configuration. Dashboard. Video and audio (media) export. Override masking.
 - b. A user, given appropriate access, may remotely configure components connected to the network.
 - c. Software permits viewing of live video from any edge device connected to any recording server on the network.
 - d. Export Icon: Simplifies process of exporting video and creating archives and saving video to media, such as: USBs, CD, DVDs or solid-state drives. An embedded player shall be optional with each exported/archived video clip for playback on any machine if configured to do so.
 - e. Event Rules: Create rules triggered by an event occurrence. Define actions executed for a given event. Events are selectable. Rules are configurable after an event is selected.
 - f. Event Association: Multiple devices may be associated with an event. Actions Triggered by Event: Configurable as On and Off. Display live video. Display a view. Go to a preset. Operate a relay. Run a PTZ tour. Run a view tour. Start a URL. Delay function.
 - g. Scheduled Recordings: Applies to cameras, encoders and microphones. Scheduling is based on rules configurable for actions the system takes upon an event. Schedules accessible on recording tab in device configuration. Create and Schedule Recordings: By authorized users. How often schedules repeat; weekly, monthly, yearly or never. Determines how the systems prioritizes schedules if schedule times overlap. Schedules available when configuring recording and rules, saving the need to create multiple and duplicate schedules. Sequencing cameras, including multi-screen displays. Record cameras at different qualities and frame rates from any recorder on the network. Schedule shall allow running preconfigured combinations of camera, sensor and PTZ programmed routines.
 - h. System Components: Application/Web Server: Act as main system server; Windows based. Global configuration of the system is stored on this server. Recording Servers (NVRs): Windows based providing communication, live streaming, recording, video playback and audio from cameras and encoders.
 - i. Device Configuration: Valid devices to be configurable for system recognition and operation. Cameras, fixed or with integrated PTZ. Microphones. Encoders. Sensors. Relays.
 - j. Authentication: Video from cameras are enabled to verify the authentication of the video and present an authentication symbol on the displayed video for recorded playback through the player when enabled only on export.
7. User Interface for VMS:
 - a. User Friendly Tabs: Allow monitoring of live and playback video, and configuration of the system.
 - b. Login Window: Consists of User Name and Password fields. Default User Name and Password: Available for initial login. Configurable for increased security.
 - c. Serve operators, supervisors and system administrators.
 - d. Monitoring Display Screen:
 - 1) Selection of number of tiles to display.
 - 2) Resource list of devices in system. Viewable as flat list or hierarchical list based on user configured groups. Resources include names of devices and icons depicting devices. Video Channels (cameras) connected, differentiating between PTZ and fixed cameras. Audio Channels (microphones). Views. Tours. Web Pages. Relay Outputs.
 - 3) Display Area: Offers display configurations up to 25 tiles. Full screen View: Available. More views added by clicking the plus sign to create new view tabs while not losing the default view. Controls: Change the layout. Stop all displays. Export. Synchronize playback. Control current selected tab.
 - 4) Camera Controls: Display at top of a tile when mouse hovers and may be locked in place. Playback. PTZ control. Digital zoom. Unmask. Export. Configuration settings
 - 5) Playback controls: Visible when cameras go to playback. Looping a video section. Slow mode. Play from time. Rewind, fast rewind, pause, forward, and fast forward. Back to live video and current time.
 - 6) Access to all available programming menus.
 - 7) Viewing live devices is performed by dragging a device to any tile. Audio devices display in a smaller area below the video tiles.
 - e. Dashboard and Configuration Menu Access: Clicking a tab at the top of the screen.
8. Video Quality for VMS: Support any resolution video, jpeg and H.264 compression.
9. Add-Ins for VMS

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- a. Access Control Systems (Security Management System (SMS)): Available for integration.
 - 1) Meet requirements of business and government access control systems.
 - 2) Monitor and control facility access as well as video detection, temperature and communications loss monitoring.
 - 3) Provide control and access to users on Local Area Networks (LAN), Wide Area Networks (WAN), wireless networks and the Internet.
 - 4) Video viewing playback and PTZ control from the VMS.
10. Digital Servers: Preloaded with Avigilon Control Center VMS.
 - a. Certifications: UL, CE, FCC Class A.
 - b. Application and Recording (NVR) Servers: PC computer fully equipped with the Digital VMS, with an external monitor, keyboard and mouse for operation.
 - 1) Standard recording server.
 - 2) Operating System: Microsoft Windows 10 LTSC* (64-bit).
 - 3) Operating System: Microsoft Windows 10 (64-bit).
 - 4) Minimum Requirements: Refer to Common Features for Digital Video System Computers specified herein.
 - c. Client Viewing Station: Available with 2 (maximum) monitor outputs per viewing station.
 - d. Electrical Parameters for Digital Servers:
 - 1) Certifications: UL, CE, FCC Class A.
 - 2) Input Voltage: 105 to 240 VAC, plus or minus 10 percent at 50 to 60 Hz.
 - 3) Current: 0.66 A at 115 VAC; 0.33 A at 240 VAC.
 - 4) 8-bay internal storage: 1.5 A at 115 VAC; 0.75A at 240 VAC.
 - 5) 24-bay internal storage: 8.8 A at 115 VAC; 4.4A at 240 VAC.
 - 6) Power Consumption: 76 W. 8-bay internal storage: 178 W. 24-bay internal storage: 1010 W; includes redundant power supply.
 - 7) Heat Output: 266 btu/hour.
 - 8) Front Panel Controls and Indicators: Power, network activity LEDs, USBs.
11. Mechanical Parameters.
 - a. Application: Indoor. All dimensions and weights are an approximation. Provide CPU enclosure that will accommodate CPU buildout.
 - b. Mounting: ITX-mini desktop case, mini desktop or rack unit mounted in a standard EIA compliant rack, 19 in. (483 mm) wide opening. Rack height is 1.75 in. (44 mm) or 1 RU.
 - c. Rack Weight: 18.2 lbs (8.3 kg) approximately.
 - d. Rack Dimensions: Width (W): 19.0 in. (483 mm). Depth (D): 16 in. (406mm). Height (H): 1.75 in. (44.45 mm), 1 RU.
 - e. Eight-Bay Internal Storage Weight: 46.3 lbs (21 kg).
 - f. Eight-Bay Internal Storage Dimensions: Width (W): 19 in. (483 mm). Depth (D): 26 in. (660 mm). Height (H): 3.5 in. (89 mm).
 - g. Twenty-four-Bay Internal Storage Weight: 64.0 lbs (29 kg).
 - h. Twenty-four-Bay Internal Storage Dimensions: Width (W): 19 in. (483 mm). Depth (D): 28 in. (711 mm). Height (H): 7 in. (176 mm).
 - i. Desktop ITX Weight: 8.1 lbs (3.7 kg) approximately.
 - j. Desktop ITX Dimensions: Width (W): 2.13 in. (44 mm). Depth (D): 6.59 in. (167.5 mm). Height (H): 6.59 in. (167.5 mm).
 - k. Desktop ITX Mini Weight: 8.1 lbs (3.7 kg) approximately.
 - l. Desktop ITX Mini Dimensions: Width (W): 7.9 in. (200 mm). Depth (D): 7.5 in. (200 mm). Height (H): 3.15 in. (80 mm).
 - m. Construction: Steel.
 - n. Color: Black.
12. Environmental Parameters:
 - a. Operating Temperature Range: 32 to 104 degrees F (0 to 40 degrees C).
 - b. Operating Humidity Range: 0 to 95%, non-condensing.

2.03 CAMERAS FOR VIDEO MANAGEMENT SYSTEMS

- A. General:
 1. All equipment and materials used shall be standard components, regularly manufactured, regularly utilized in the manufacturer's system.
 2. All systems and components shall have been thoroughly tested and proven in actual use.
 3. All systems and components shall be provided with the availability of a toll free 24-hour immediate technical assistance for either the dealer/installer at no charge.
- B. Dome Cameras:
 1. Basis of Design: H6SL Series Indoor Fixed IP Dome Cameras as manufactured by Avigilon:

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- a. Features:
 - 1) Mounting: Indoor surface mount. Mounting accessories to allow pendant mounting or mounting to a 4x4 electrical box.
 - 2) Camera/lens: 2MP (1920x1080) High-resolution day/night camera.
 - 3) WDR and IR capability and integral motorized varifocal autoiris lens.
 - 4) Day/night operation: Built-in IR-cut filter
 - 5) IR Distance: 98 feet (30 m) @ full tele., 65 feet (20 m) @ full wide
 - 6) Powered by PoE.
 - 7) Triple streaming video, supports H.264/H.265, and M-JPEG (third stream only) compression. Provide in 1080p (2 MP) resolution.
 - 8) Back box for ease of cabling.
 - 9) Supports ONVIF interface.
 - b. Camera Features:
 - 1) Electronic iris.
 - 2) WDR.
 - 3) White balance.
 - 4) Mirror.
 - 5) Privacy masks.
 - 6) Region of Interest (ROI).
 - 7) Museum search.
 - 8) Motion detection.
 - c. Camera Parameters:
 - 1) Automatic Gain Control: On/Off selectable.
 - 2) Adjustment, Tilt and Horizontal: 3 axis. Pan 360 degrees, tilt 80 degrees, and roll. (lens may be rotated on its axis 360 degrees).
 - 3) Lens Adjustment: Motorized focus and zoom adjustment.
 - d. Physical Parameters:
 - 1) Operating Temperature: 32 to 140 degrees F (0 to 60 degrees C).
 - 2) Humidity: Up to 95 percent relative, non-condensing.
 - 3) Construction: Aluminum with clear polycarbonate dome.
 - e. Electrical Parameters:
 - 1) Input Voltage: PoE.
 - 2) Power Consumption: 10 W.
 - 3) Power Connector: Standard jack for adapter.
 - 4) PoE/Network Connectors: RJ-45.
 - 5) Alarm Connector: Screw terminal.
 - 6) Audio Connector: RCA jack.
 - 7) SD card slot.
 - 8) BNC Composite output for installation.
 - f. Network Parameters:
 - 1) Communication Platform: Open platform; compatible with Avigilon Control Center Video Management Systems.
 - 2) Compression: H.264/H.265; M-JPEG.
 - 3) LAN Interface: 10 Base-T/100 Base-TX.
 - 4) Video Channels: Triple streaming.
 - 5) Resolution and Frame Rates:
 - (a) 1080p (2 MP): 1920x1080, 1280x720/960 (720P).
 - 6) Frame Rate: Max 30 fps at 1920x1080.
 - 7) Web Browser: Internet Explorer, minimum IE8.
 - 8) Users: Up to 10 clients.
 - 9) Image Settings: Day/night mode; configurable brightness, contrast, hue, sharpness, saturation; white balance; Electronic Shutter, automatic or manual; WDR; privacy masks; motion detection.
 - 10) Supported Protocols: Ipv4/Ipv6, TCP, HTTP, HTTPS, RTSP, RTCP, RTP SMTP, DHCP, NTP, FTP DDNS, UDP, uPnP, QoS, ARP, IGMP, SNMP (V3), TLS, SSL, 802.1x, PPPoE, DNS, ICMP.
- C. 360 Panoramic Cameras:
1. Basis of Design: H5A Fisheye Series Indoor Cameras as manufactured by Avigilon:
 - a. Features:
 - 1) Mounting: Indoor surface mount. Mounting accessories to allow pendant mounting or mounting to a 4x4 electrical box.
 - 2) Camera/lens: High-resolution day/night camera.

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- 3) WDR and IR capability.
 - 4) Day/night operation: Built-in IR
 - 5) IR Distance: 55 feet (17 m)
 - 6) Powered by PoE or 12 VDC.
 - 7) Triple streaming video, supports H.264/H.265, and M-JPEG (third stream only) compression. Provide in 1080p (2 MP) resolution.
 - 8) Back box for ease of cabling.
 - 9) Supports ONVIF interface.
 - b. Camera Features:
 - 1) WDR.
 - 2) White balance.
 - 3) Tamper Detection.
 - 4) Privacy masks.
 - 5) Museum search.
 - 6) Motion detection.
 - c. Camera Parameters:
 - 1) Lens Adjustment: Fixed Iris.
 - d. Physical Parameters:
 - 1) Operating Temperature: negative 40 to 140 degrees F (negative 40 to 60 degrees C).
 - 2) Humidity: Up to 95 percent relative, non-condensing.
 - 3) Construction: Aluminum with clear polycarbonate dome.
 - 4) Dimensions:
 - (a) Surface Mount: 2.4 inch (61 mm) height by 5.7 inch (145 mm) diameter.
 - (b) In Ceiling Mount: 0.6 inch (14 mm) height by 7.9 inch (200 mm) diameter by 3.9 inch (99 mm) deep.
 - 5) Surface Mount or In Ceiling Mount as conditions allow.
 - e. Electrical Parameters:
 - 1) Input Voltage: 12 VDC or PoE.
 - 2) Power Consumption: 11 W (26 W with IR).
 - 3) Power Connector: Standard jack for adapter.
 - 4) PoE/Network Connectors: RJ-45.
 - 5) Alarm Connector: Screw terminal.
 - 6) Audio Connector: RCA jack.
 - 7) SD card slot.
 - 8) BNC Composite output for installation.
 - f. Network Parameters:
 - 1) Communication Platform: Open platform; compatible with Avigilon Control Center Video Management Systems.
 - 2) Compression: H.264/H.265; M-JPEG.
 - 3) LAN Interface: 10 Base-T/100 Base-TX.
 - 4) Video Channels: Triple streaming.
 - 5) Resolution and Frame Rates:
 - (a) 2048p (8 MP): 2048x2048; 512x512 (720P).
 - 6) Frame Rate: Max 30 fps at 60 Hz.
 - 7) Web Browser: Internet Explorer, minimum IE8.
 - 8) Users: Up to 10 clients.
 - 9) Image Settings: Day/night mode; configurable brightness, contrast, hue, sharpness, saturation; white balance; Electronic Shutter, automatic or manual; WDR; privacy masks; motion detection.
 - 10) Supported Protocols: Ipv4/Ipv6, TCP, HTTP, HTTPS, RTSP, RTCP, RTP SMTP, DHCP, NTP, FTP DDNS, UDP, uPnP, QoS, ARP, IGMP, SNMP (V3), TLS, SSL, 802.1x, PPPoE, DNS, ICMP.
- D. Verkada Dome Cameras:
1. Basis of Design: CM22 Series Indoor Fixed IP Dome Cameras as manufactured by Verkada:
 - a. Features:
 - 1) Mounting: Indoor surface mount. Mounting accessories to allow pendant mounting or mounting to a 4x4 electrical box.
 - 2) Camera/lens: 3MP (2048x1536) High-resolution day/night camera.
 - 3) WDR and IR capability.
 - 4) Day/night operation: Built-in IR-cut filter
 - 5) IR Distance: 33 feet (10 m)
 - 6) Powered by PoE.

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- 7) Supports H.264/H.265
 - 8) Back box for ease of cabling.
 - 9) Device internal storage for 30 days of recording.
 - 10) Verkada cameras to be connected to County Enterprise Network, coordinate with County IT.
- E. Manufacturer requires the use of uninterruptible power supply systems (UPS) to prevent voltage fluctuations that can affect operation and cause damage to the equipment. Div 26 Contractor to provide all Emergency Generator Power with UPS back up to the Digital Video System.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

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

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved submittals.

3.04 PROTECTION

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

END OF SECTION

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SECTION 284600 FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire alarm system design and installation, including all components, wiring, and conduit.
- B. Transmitters for communication with supervising station.

1.02 RELATED REQUIREMENTS

- A. Section 14 24 00 - Hydraulic Elevators: Elevator systems monitored and controlled by fire alarm system.
- B. Section 21 13 00 - Fire-Suppression Sprinkler Systems: Supervisory, alarm, and actuating devices installed in sprinkler system.
- C. Section 21 22 00 - Clean-Agent Fire-Extinguishing System: Supervisory, alarm, and releasing devices installed in extinguishing system.
- D. Section 21 30 00 - Fire Pumps: Supervisory devices.
- E. Section 23 33 00 - Air Duct Accessories: Smoke dampers monitored and controlled by fire alarm system.
- F. Section 27 51 29.13 - Rescue Assistance Signal Systems: Two-way emergency communication systems for areas of refuge/rescue assistance.

1.03 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- C. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.
- F. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Evidence of designer qualifications.
- C. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
 - 1. Copy (if any) of list of data required by authority having jurisdiction.
 - 2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
 - 3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
 - 4. System zone boundaries and interfaces to fire safety systems.
 - 5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
 - 6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
 - 7. List of all devices on each signaling line circuit, with spare capacity indicated.
 - 8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
 - 9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
 - 10. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.

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11. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.
 12. Certification by Contractor that the system design complies with Contract Documents.
- D. Evidence of installer qualifications.
- E. Evidence of instructor qualifications; training lesson plan outline.
- F. Evidence of maintenance contractor qualifications, if different from installer.
- G. Inspection and Test Reports:
1. Submit inspection and test plan prior to closeout demonstration.
 2. Submit documentation of satisfactory inspections and tests.
 3. Submit NFPA 72 "Inspection and Test Form," filled out.
- H. Operating and Maintenance Data:
1. Complete set of specified design documents, as approved by authority having jurisdiction.
 2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
 3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
 4. List of recommended spare parts, tools, and instruments for testing.
 5. Replacement parts list with current prices, and source of supply.
 6. Detailed troubleshooting guide and large scale input/output matrix.
 7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
 8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.
- I. Project Record Documents:
1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
 2. "As installed" wiring and schematic diagrams, with final terminal identifications.
 3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.
- J. Closeout Documents:
1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
 2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
- K. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.
1. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data and place in spare parts cabinet.

1.05 QUALITY ASSURANCE

- A. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.
- B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
 2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
 3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
- C. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.
- D. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.

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1.06 WARRANTY

- A. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.
- B. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 PRODUCTS

2.01 FIRE ALARM SYSTEM

- A. Fire Alarm System: Provide a new automatic fire detection and alarm system:
 - 1. Provide all components necessary, regardless of whether shown in Contract Documents or not.
 - 2. Protected Premises: Entire building shown on drawings.
 - 3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
 - a. ADA Standards.
 - b. The requirements of the local authority having jurisdiction .
 - c. Applicable local codes.
 - d. Contract Documents (drawings and specifications).
 - e. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
 - 4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
 - 5. Voice Notification: Provide emergency voice/alarm communications with multichannel capability; digital.
 - 6. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
 - 7. Program notification zones and voice messages as directed by Owner.
 - 8. Fire Command Center: Location indicated on drawings.
 - 9. Fire Alarm Control Unit: New, located at fire command center.
- B. Supervising Stations and Fire Department Connections:
 - 1. Public Fire Department Notification: By on-premises supervising station.
 - 2. On-Premises Supervising Station:
 - 3. Means of Transmission to On-Premises Supervising Station: Directly connected noncoded system.
- C. Circuits:
 - 1. Initiating Device Circuits (IDC): Class B, Style A.
 - 2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
 - 3. Notification Appliance Circuits (NAC): Class B, Style W.
- D. Power Sources:
 - 1. Primary: Dedicated branch circuits of the facility power distribution system.
 - 2. Secondary: Storage batteries.
 - 3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
 - 4. Each Computer System: Provide uninterruptible power supply (UPS).

2.02 FIRE SAFETY SYSTEMS INTERFACES

- A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
 - 1. Sprinkler water control valves.
 - 2. Dry-pipe sprinkler system pressure.
 - 3. Dry-pipe sprinkler valve room low temperature.
- B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
 - 1. Sprinkler water flow.
- C. HVAC:
 - 1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

2.03 COMPONENTS

- A. General:

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1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
 2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.
- B. Fire Alarm Control Units: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.
- C. Master Control Unit: As specified for Basis of Design above, or equivalent.
- D. Initiating Devices:
1. Addressable Systems:
 - a. Addressable Devices: Individually identifiable by addressable fire alarm control unit.
 - b. Provide suitable addressable interface modules as indicated or as required for connection to conventional (non-addressable) devices and other components that provide a dry closure output.
- E. Notification Appliances:
- F. Circuit Conductors: Copper or optical fiber; provide 200 feet extra; color code and label.
- G. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.
- H. Locks and Keys: Deliver keys to Owner.
- I. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
 2. Provide one for each control unit where operations are to be performed.
 3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
 4. Provide extra copy with operation and maintenance data submittal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and Contract Documents.
- B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.
- C. Obtain Owner's approval of locations of devices, before installation.
- D. Install instruction cards and labels.

3.02 INSPECTION AND TESTING FOR COMPLETION

- A. Notify Owner 7 days prior to beginning completion inspections and tests.
- B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.
- D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.
- E. Provide all tools, software, and supplies required to accomplish inspection and testing.
- F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
- G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.03 OWNER PERSONNEL INSTRUCTION

- A. Provide the following instruction to designated Owner personnel:
 1. Hands-On Instruction: On-site, using operational system.
 2. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.
- B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:
 1. Initial Training: 1 session pre-closeout.

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- C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
 - 1. Initial Training: 1 session pre-closeout.
- D. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

3.04 CLOSEOUT

- A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
 - 1. Be prepared to conduct any of the required tests.
 - 2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
 - 3. Have authorized technical representative of control unit manufacturer present during demonstration.
 - 4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
 - 5. Repeat demonstration until successful.

3.05 MAINTENANCE

- A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.
- B. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
 - 1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
 - 2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
 - 3. Record keeping required by NFPA 72 and authorities having jurisdiction.
- C. Provide trouble call-back service upon notification by Owner:
 - 1. Provide on-site response within 2 hours of notification.
 - 2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
 - 3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.
- D. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.
- E. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.
- F. Comply with Owner's requirements for access to facility and security.

END OF SECTION

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SECTION 285000 SECURITY MANAGEMENT SYSTEM

PART 1 GENERAL

1.01 SUMMARY

- A. Applicable provisions of Division 1 shall govern all work under this Section.

1.02 SECTION INCLUDES

- A. General description, functional requirements, operational characteristics, and criteria for the Security Management System (SMS).

1.03 RELATED SECTIONS

- A. Division 8 – Hardware, Doors, and Frames
- B. Division 26 - Electrical: Electrical systems and components.
- C. Division 27 – Telecom Systems
- D. Division 28 – All Sections

1.04 DEFINITIONS

- A. API: Application Programming Interface.
- B. LDAP: Lightweight Directory Access Protocol.
- C. NTSC: National Television Standards Committee.
- D. SMS: Security Management System.
- E. ADO: Automatic Door Operator

1.05 REFERENCE STANDARDS

- 1. UL 294 - Access Control System Units; Current Edition, Including All Revisions.
- 2. UL 1076 - Proprietary Burglar Alarm Units and Systems; Current Edition, Including All Revisions.
- 3. UL 1610 - Central-Station Burglar-Alarm Units; Current Edition, Including All Revisions.
- B. Where more than one (1) reference standard, code, or regulation applies, the more stringent one shall govern.
- C. Electronic Industries Alliance (EIA):
 - 1. EIA RS-170 - Standard for Composite Video Signals.
- D. European Union (EU):
 - 1. Restriction of the Use of Certain Hazardous Substances (RoHS) in Electronic Equipment Regulations 2002/95/EC.
- E. Federal Communications Commission (FCC).
 - 1. FCC Part 15 - Unlicensed RF Devices EME/EMC.
 - 2. FCC Part 68 - Requirements for Connecting to the U.S. Phone Network.
- F. Institute of Electrical and Electronics Engineers, Inc. (IEEE).
- G. International Organization for Standardization (ISO).
- H. International Radio Consultive Committee (CCIR).
- I. Microsoft® Open Database Connectivity (ODBC) Interface.
- J. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code.
- K. National Institute of Standards and Technology (NIST):
 - 1. NIST SP800-116
 - 2. Federal Information Processing Standards Publication (FIP PUBS 197) - Specification for the Advanced Encryption Standard (AES).
- L. National Television Standards Committee (NTSC):
 - 1. Color Camera Broadcast Standard.

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- M. Underwriters Laboratories Inc. (UL):
 - 1. UL 294 - Standard for Access Control System Units.
 - 2. UL 1076 - Standard for Proprietary Burglar Alarm Units and Systems.
 - 3. UL 1981 - Standard for Central-Station Automation Systems.
 - 4. UL 1610 Central Station Automation System Software.

1.06 SECURITY MANAGEMENT SYSTEM (SMS) DESCRIPTION

- A. The Security Management System (SMS) outlined in this section and detailed in Part 2 of this section is the key central component for managing physical security and the bridge between physical and logical security for a project. The system shall provide a variety of integral functions including: regulation of access and egress; provision of identification credentials; and monitor, track and interface alarms.
- B. The SMS is existing within the Mesa County Court's Building. These specifications have been edited in an effort to reflect the existing SMS. Where deviations between this specification and existing systems occur, the contractor is to match existing and coordinate these discrepancies with the Owner's Representative.
- C. The SMS is to be a segmented system, which allows different departments to have administrative rights over the card readers in their areas. Contractor to coordinate with Owner on designation of departments and administrative writes to those department segregations.
- D. Upgrades or expansion of the SMS to a larger size system in scale shall not require installation of a different and/or new SMS application or require the administrator or operator to learn a different and or new interface from the previous version.
- E. The SMS shall be UL 1076 Listed.
- F. The SMS shall be UL 1981 Listed.
- G. The SMS shall be UL 1610 Listed.
- H. The SMS shall have FIPS 140-2 certification.
- I. The SMS shall have FIPS 197 certification.
- J. The SMS shall have NIST SP800-116 support.
- K. The SMS shall support concurrent licensing with respect to client licenses. CUSTOMER shall purchase a fixed number of client workstation licenses (or connections) that shall be programmed into the database server license file. The SMS shall be installed on any number of client workstations in the CUSTOMER facility. Then, any of the client workstations that have the SMS software installed shall have the ability to connect to the database server as long as the maximum number of concurrent connections purchased has not been reached. Connections shall be licensed on a per module basis. This shall provide CUSTOMER with great flexibility in system design and layout.
- L. The SMS shall provide support for single sign-on capability. Single sign-on shall allow System Administrators or System Operators to authenticate into SMS applications using their Windows domain account.
- M. Single sign-on shall support the following scenarios:
 - 1. Allow System Administrators or System Operators to interactively run SMS applications without having to enter a username or password. This shall make administration of the SMS easier since maintenance of separate SMS usernames and passwords is not required.
 - 2. Allow SMS API scripts to authenticate. These scripts shall be run using a Windows account allowing a seamless and secure way to authenticate the account and restricting the script to those actions that the user is permitted to perform.
- N. The SMS shall be able to seamlessly interface with and monitor intelligent system controllers, reader interface modules, I/O panels, alarm panels, alarm panel receivers, fire alarm panels (secondary monitoring only), building management systems and digital video recorders approved for use by the SMS manufacturer.
- O. Utilize an open architecture where all data must reside on a single database and must be accessible in real time to SMS workstation or Web-based client connected to the network. The system shall be configurable to support all of the following databases: Microsoft SQL Server 2012 Express, Microsoft SQL Server 2012 R1, , Microsoft SQL Server 2014 R1/R2 and Express, Microsoft SQL Server 2016, Oracle Server 11g R1 and R2, and Oracle Server 12c R1. Oracle data may reside on Windows or UNIX platforms.

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- P. The SMS shall be an expansion of the existing RS2 access control system. Provide additional expansion license(s) as required.

1.07 SUBMITTALS

- A. See 28 00 00 General Low Voltage Requirements.
- B. Shop Drawings: Provide drawings for coordination of electrician-provided conduit and for 'Head End' and perimeter panel room planning.
 - 1. Standard door prep. Includes recommended conduit sizes and their positioning at door.
 - 2. Standard Panel Layout
 - 3. Standard Head End layout.
- C. Operation and Maintenance Data: For electronic security system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23, include the following:
 - 1. Provide set of electronic format manuals including operating instructions, maintenance recommendations and parts list including wiring and connection diagrams modified to reflect as-built conditions.
 - 2. Contractor to provide local operators of system a 3-hour training covering, at minimum:
 - a. System design overview at facility
 - b. Add/Delete of users
 - c. Activity reports
 - d. Alarm Monitoring and acknowledgement.
 - e. Recommended PM procedures and service response plans.
 - 1) As-Built Drawings: During system installation, the Contractor shall maintain a separate hard copy set of drawings, elementary diagrams, and wiring diagrams of the SMS to be used for record drawings. This set shall be accurately kept up to date by the Contractor with all changes and additions to the SMS. Copies of the final as-built drawings shall be provided to the end user in AutoCAD format.

1.08 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. SMS manufacturer shall be an established organization with referenced and documented experience delivering and maintaining SMS of equal or higher sophistication and complexity as compared to the system detailed in this specification.
- B. Bidder Qualifications:
 - 1. At the time of the bid, the bidder shall be a factory authorized local service organization that shall carry a complete stock of parts and provide maintenance for the SMS and related systems under this contract.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Manufacturer: The security management system is based on the existing products by RS2 Technologies.
- B. Substitutions will not be considered.

2.02 SMS SOFTWARE

- A. Security Management System (SMS) Software: Access It! Universal.NET.

2.03 SMS FIELD HARDWARE

- A. Security Management System (SMS) Hardware: The SMS shall be equipped with the access control field hardware required to receive alarms and administer all access granted or denied decisions. All field hardware must be designed to meet UL 294 requirements. The SMS must be able to retrieve device serial numbers from all field hardware, excluding card readers, biometric readers, and keypads. Depending upon the configuration, the SMS field hardware must be able to include any or all of the following components:
 - 1. Intelligent System Controllers (ISC):
 - 2. Intelligent Single Door Controller (ISDC):
 - 3. Advanced Dual Reader (ADRC):
 - 4. Input Control Module (ICM):

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5. Output Control Module (OCM):
 6. Single Reader Interface Module (SRI):
 7. Dual Reader Interface Module (DRI):
 8. Power supplies and enclosures
 9. UL, CUL, and CE listed power supplies and enclosures
- B. SMS Authentication Hardware:
1. HID Proximity Readers
- C. SMS Software Capabilities: Support an unlimited number of card readers, input points, video cameras, intrusion detection points, and relay outputs. The SMS database server shall support an unlimited number of cardholders, visitors, and assets limited only by the available memory on the ISC. The database server shall also support an unlimited number of system events and System Operator transactions in the history file limited only by available hard disk space. Client Workstations shall be limited only by the limitations of the operating system server software. The SMS functions are categorized into nineteen primary "system modules" which shall include:
1. Access Control: One of the SMS's primary purposes shall be to provide access control. The SMS shall be able to make access granted or denied decisions, define access levels, and set timezones and holidays.
 2. Alarm Monitoring: The main Alarm Monitoring window shall provide information about the time and location of the alarm, along with its priority.
 3. Credential Management: The SMS shall include a seamlessly integrated credential management module.
 4. Visitor Management: The SMS shall include a visitor management module.
 5. Remote Access Level Management: The SMS shall include a seamlessly integrated remote access level management module.
 6. Third-Party Interfaces: The SMS shall integrate with a number of third-party hardware and software products.
 7. System Administration: System Administrative tasks such as defining client workstation and System Operator permissions set-up, access groups, timezones, reports, maps, etc. shall be provided from any client workstation on the network.
 8. Badge Layout Creation: The SMS shall provide a Badge Layout Creation and Editing Module to allow for the creation of custom badge designs to be created by the CUSTOMER.
 9. Screen or Forms Creation: The SMS shall provide a Forms Designing and Editing Module that gives System Administrators the ability to modify any standard field to customize any or all of the cardholder, asset, or visitor forms.
 10. Graphical Map Creation: The SMS shall provide Graphical Map Creation and Editing Software that must allow System Administrators to import customized map backgrounds of their facility and to attach custom icons to those maps.
 11. Data Import: The SMS shall support an import utility that shall allow the CUSTOMER or VAR to import cardholder information into the SMS database.
 12. Bi-Directional Data Exchange: The SMS shall support a real time, bi-directional data interface to external databases such as Human Resources, Time and Attendance, Food Service Systems.
- D. SMS Software Functionality:
1. Timezones: The SMS shall be capable of creating and storing up to 255 timezones. Each timezone shall have a minimum of six (6) intervals.
 2. Access Levels: Capable of defining a minimum of 32,000 access levels with a minimum of 128 access levels per cardholder per database segment.
 3. Temporary Access Levels: Capable of assigning Temporary Access Levels inclusive of the 32,000 assignable Access Levels.
 4. Access Groups: The SMS shall be capable of assigning Access Groups with a maximum of 32 Access Levels per Access Group.
 5. Holidays: The SMS shall provide a minimum of 255 Holiday assignments using an embedded calendar.
 6. First Card Unlock: Feature that when configured retards a pre-determined timezone activated unlock command until a valid credential has been presented and granted access to the portal.
 7. SMS to Intelligent System Controller Encryption: Data security for encrypted connections between SMS and Intelligent System Controllers shall be provided by the full implementation of the Federal Information Processing Standard, FIPS-197, utilizing the 128-bit Advanced Encryption Standard (AES), also known as Rijndael, a symmetric encryption algorithm.
 8. Intelligent System Controller to Reader Interface and I/O Module Encryption: Data security for encrypted connections between Intelligent System Controller and downstream modules (Reader

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- interface and I/O Modules) shall be provided by utilizing the 128-bit Advanced Encryption Standard (AES), also known as Rijndael, a symmetric encryption algorithm.
9. Mustering: The SMS shall support advanced mustering functionality.
 10. Alarm Masking Groups: Support a group alarm masking feature whereas System Administrators shall be able to create groups of alarm inputs that enable them to mask or unmask multiple Input Control Module inputs and card reader inputs simultaneously.
 11. Global Input or Output or Event Linkage: Support a global linkage feature whereby any input or output or event shall be linked to any other input or output or event in the SMS.
 12. Cardholder Escort Control: Support comprehensive escort functionality based upon Access Levels.
 13. Cardholder Use Limits: Support a Cardholder Use Limit feature that shall allow System Administrators to specify the maximum number of times that a cardholder may use their credential at card readers in the SMS.
 14. Alarm or Event Logging: All alarms and events in the SMS shall by default, always be recorded in the database.
 15. Scheduling Utility: An integral Scheduling Utility shall be provided.
 16. Multiple Card Formats: Support an unlimited number of card formats.
 17. Card Reader Timezone Overrides: Allow for the pre-defined default card reader settings to be overridden or temporarily changed on a timezone basis.
 18. Alarm or Event Routing: The SMS shall be capable of allowing System Administrators to route alarms and events to various alarm monitoring client workstations on the network.
 19. Customizable Voice Instructions: Allow for a customizable voice instruction to be associated with SMS alarm.
 20. Customizable Voice Annunciation: Allow for a customizable voice annunciation to be associated with SMS alarms.
 21. Alarm Monitoring on Multiple Windows: Alarm Monitoring shall be able to be displayed on multiple windows.
 22. Pending Alarm Windows: The SMS shall support a Pending Alarm Window in the Alarm Monitoring Workstation.
 23. Color Coding for Alarm Priorities: Display alarms in the active alarm monitoring window with a flashing colored bar across the alarm based upon priority.
 24. Highlighting of Unacknowledged Alarms: The SMS shall allow for unacknowledged alarms to automatically be displayed in a pop-up window after a user-defined amount of time.
 25. Cardholder Record Call-up: From the alarm monitoring window, the System Operator must be able to display a cardholder record with the stored cardholder's image.
 26. Inactive Badge Alarm: The SMS shall provide an alarm, indicating current badge status, if an attempt to gain access is made with a badge that has a status set to any value other than "Active" in the cardholder record.
 27. Request to Exit Event: The SMS shall provide an event when a Request to Exit (REX) is used.
 28. Real-Time, Live Video User Verification: Have the capability to interface with a CCTV system and display a live video image next to a stored cardholder image record.
 29. Cardholder Photo Verification: From the alarm monitoring window, the SMS shall optionally display the stored cardholder photo for each credential presented at the user-specified reader(s).
 30. CCTV Interface Option
 - a. Real-Time, Dynamic Graphical Maps: Support graphical maps that display device or group status, function lists and video cameras dynamically in real-time.
 31. E-mail Interface Option: Support an e-mail interface seamlessly integrated within the SMS Alarm Monitoring application.
 32. Biometric Verification: Biometric verification shall be available as a seamlessly integrated solution with other SMS modules. Through the measurement and comparison of human characteristics such as fingerprints, hand geometry, or Iris imaging, the SMS shall have the capability to verify the identity of enrolled individuals.
 33. Cardholder Self Service (CSS): The SMS shall provide a web portal for all or designated cardholders to see doors for which they have recently been denied access, see a configurable list of available doors, and to send an automated request for access to designated approvers.
 34. Digital Video Management: The Digital Video Management System (DVMS) shall be available as a standalone solution or as an integrated solution that is seamlessly integrated with other SMS Modules, including Access Control and Alarm Monitoring, and Visitor Management.
 35. Visitor Management System (VMS): A standalone system or a seamlessly integrated system within the SMS. The functionality described below reflects the functionality of the seamlessly integrated system:
 36. Visitor Self Service: The SMS shall provide a Visitor Self Service kiosk application, (KIOSK), The KIOSK shall be an iPad tablet app that allows visitors to sign themselves in or out for events without

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- assistance.
37. Bulk User Import Tool: The user logging into Visitor Management Host, Administration, Front Desk, or Kiosk must be a cardholder. This cardholder must be paired with a user. This is typically done in System Administration by creating a directory, linking the cardholder with the directory account, then linking the user to that same directory account. The Bulk User Import Tool shall be for quickly adding and linking users to their cardholder directory accounts.
 38. Custom Report Writer: The SMS shall support an industry standard, off the shelf, custom report writer, such as Crystal Reports 11.5, 12, or 14. The custom report writer shall support multiple report types including, but not limited to, multiple section reports, form style reports, conditional reports, query reports, and columnar reports. The custom report writer shall have BLOB Bitmap support and shall come standard with a formula editor with more than 160 built in functions for System Operators to manipulate data. It shall have export capabilities to ASCII files, Microsoft Mail, or ODBC file formats. The custom report writer shall be compatible with industry standard SQL databases, such as Microsoft SQL Server 2008 SP2 or SP3, SQL Server 2008 R2 SP1 and SP2, SQL Server 2012 SP1 and Express, SQL Server 2014 and Express.
 39. Client Workstations: System Administrators shall have the ability to configure each client workstation on the SMS to utilize any combination of event printers, CCTV controllers, and video capture boards. For each printer or CCTV controller, System Administrators shall be able to select the port that the device is connected to on the client workstation and the communications speed.
 40. PIN Numbers: The SMS shall have the ability to support up to nine (9) digit PIN Numbers for each cardholder in the SMS. PIN Numbers shall be created either manually through System Operator entry or generated randomly by the SMS. The SMS shall have the ability to be configured to allow for unique PINs for each cardholder and the ability to modify cardholder's PIN numbers at a later date.
 41. List Builder: System Administrators shall have the ability to pre-define information that shall appear in each of the pre-defined drop-down lists. There shall be no limit to the number of items that shall be a part of a list. Lists can have items added to them or deleted from them at any time.
 42. Archiving: The SMS shall allow System Administrators to archive offline history files to magnetic media.
 43. Reader Groups: The SMS shall support reader groups.
 44. Map Editor Module: The SMS shall support graphical map creation software that shall allow the import of map backgrounds from any standard 'off-the-shelf' drawing package.
 45. Import Module: The SMS shall support an import utility, which shall allow the CUSTOMER or VAR to import cardholder information into the SMS database.
 46. Print Report Options in the System Administration application The SMS shall support exporting reports to a variety of output files. These files shall include:
 - a. Adobe Acrobat (PDF)
 - b. Crystal Reports (RPT)
 - c. HTML 4.0
 - d. Microsoft Excel 97-2000 (XLS)
 - e. Microsoft Word (DOC)
 - f. Rich Text Format (RTF)
 - g. Separated Values (CSV)
 - h. Text (TXT)
- E. Door hardware. RS2 Integrator shall coordinate and connect to all door hardware components that are part of the Access Control System.
1. Provider of Doors and Frames to ensure doors are cored and prepped as necessary.
 2. Provider of Door Hardware to ensure the proper hardware is supplied to support the Access Control System.
 3. Integrator responsible for connecting to and controlling all designated Electrified Door Hardware.
- F. Wiring, Conduit, and Pathways
1. Integrator shall be responsible for wiring infrastructure through the building wherever there is accessible ceiling
 2. Inside of walls and above hard-deck/inaccessible ceiling, conduit shall be provided through General contractor.
 3. General Contractor to provide and install minimum of 4x4 inch security junction box in the accessible ceiling space above or near each card reader door. Install junction box so that it is accessible from the secured side of the door and not blocked by exit lighting, air grills, vents, sprinklers, smoke detectors, or other building components. Box shall be accessible from the secured side of door, unless space does not permit.

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4. General Contractor to provide conduit/raceways not to exceed 40% fill at any point with runs not exceeding 500 feet.
5. General Contractor to provide conduit/Panduit door prep as shown in standard door prep attached documentation
6. Integrator to coordinate all conduit size needs with the General Contractor.
7. Integrator shall use shielded cable as necessary and as shown on Drawings to preclude any outside noise or interference from entering the cable and degrading system performance and shall follow all system manufacturer cable requirements.
8. Cable shall be 18-gauge for all lock hardware. No smaller gauge cable shall be used.
9. Integrator shall use outdoor-rated cable for all runs that reach the exterior.
10. Firewall penetrations to include fire caulk per code. Refer to Div 7 Penetration Firestopping.
11. Wireless devices are not permitted.
12. A minimum of 1-4" conduit is to be provided in between floors and reserved exclusively for security.
13. Wire runs shall NOT be shared with network cable; which includes network cable for video security system.
14. All cable shall be labeled at origin and termination, referencing to a master legend schedule shown on submittal and/or as-installed drawings. Labeling and any splice locations shall be noted on final drawings. Refer to Section 28 05 53 Low Voltage Identification for labeling requirements.

G. Card Readers

1. All card readers shall be manufactured by HID Global.
2. Card readers shall all be Black in color
3. Card readers shall all be multiclass w/ Proximity
4. Card readers will mount on standard single gang electrical rings. Mullion mounted readers to be installed only if necessary when mounting to door frame.
5. Card readers installed at vehicle parking gates shall have an extended reader range and must include buffer plates.
6. Card readers shall have keypads with ability to use dual-authentication only where specifically noted.

H. REX, DPS, and Sounders

1. Integrator shall ensure that all access control points shall have a Request-to-Exit sensor (REX). REX must be built into the exit device/handset. A separate REX device must be included with Electric Strikes and Magnetic Locks (overhead motion REX to match Bosch DS150i or approved equal).
2. Automatic Door Operators (ADO's) MUST have separate receivers for the Opener on either side for it to integrate with access control locks. Dual receivers and ADO buttons are to be provided by ADO installer.
 - a. The ADO buttons are to provide inputs to the SMS. This will prevent the ADO for attempting to open when a card read hasn't been validated.
 - b. The ADO button on the exterior (non-secure side) shall send a signal to the SMS during normal business hour, at public access doors only. In this instance the SMS shall be programmed so the lock will remain open and the ADO button will actuate the ADO. In off business hours, a valid card read will send a signal to the SMS, which will send a signal to the lock to open and a signal to the ADO to open the door. The SMS will disable the function of the ADO button during off business hours.
 - c. The ADO button on the interior (secure side) will provide an input to the SMS as a REX and unlock the door and actuate the ADO at all times.
3. On sets of double doors, each leaf shall have a DPS.
4. Frame provider to have door frames pre-drilled and reinforced (if necessary) to accommodate door contacts.
5. DPS's shall all be recessed unless frame prohibits.

2.04 PANEL AND HEAD END CONFIGURATIONS

- A. Access Control Panels (ACP). Rooms where Access Control panels reside are commonly referred to as "Head End(s)."
 1. Access control Head End location must reserve an area of about 7 feet wide, and 4 feet deep floor to ceiling in a room on each floor.
 2. Install a 4-plex power on its own circuit into each head end room of each floor in the identified area; running conduit down the right or left side boundary edge of the area. In other words, don't run the power down the middle of the area that has been reserved for the head end equipment. Emergency Generator Power with UPS backup to be provided and installed by Div 26 Contractor.

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3. Integrator to provide and install [RS2] Intelligent System Controller in main security equipment panel location(s).
4. Access control panels shall support all of the devices associated with that panel location as shown on the drawings
5. Access Control panels shall monitor, power and control card readers, door alarm contacts, electrified door locks and other devices as shown on the drawings
6. Daisy-chaining, multi-tapping, or multi-dropping of card reader communication runs shall not be permitted.
7. At ACP locations, contractor to provide and install [RS2] enclosure, mounting panel, and cylinder lock kit for all RS2 panels.
8. Enough room is needed for the enclosure door swing of 36 inches plus standing room. A four-foot allocation in front of the enclosure is adequate.
9. Each head end must be secured and access controlled.
10. Integrator shall furnish and install tamper switches on each Enclosure and Power Supply enclosure and shall be configured for 24-hour alarm supervision. Tamper switches may be run in series as one input per enclosure/power supply location.
11. Access Panel Controller, I/O boards and power supplies for control boards and locks shall be provided with battery back-up sufficient to maintain full operation of monitoring functions for a minimum of 4 hours, plus a minimum of 25 lock activations in the event of power failure.
12. Lock Power Supplies
 - a. Integrator shall install dual-voltage power supplies.
 - b. Provide sufficient quantity of power supplies with factory-installed power distribution modules to permit simultaneous continuous-duty activation of all door locks with an additional minimum 20 percent capacity on each supply.
 - c. Provide and install cabinet locks on each power supply enclosure
13. Fire alarm connections, if applicable, to be provided by fire contractor. Permits, submittals, and testing to be provided by fire contractor.
14. Use proper grounding practices to eliminate shorts, ground faults, ground loops, RF interference, voltage fluctuations, and foreign voltages and open circuits.
15. Div 26 Contractor to provide direct power (from emergency generator with UPS backed up circuit) into power supplies. Emergency generator and UPS power are responsibility of Div 26 Contractor.
16. Programming: Integrator shall provide initial programming for system and all its components. Integrator shall coordinate all programming parameters with the Owner's representative.
17. Integrator shall program IP addresses into controllers and tie in to Community's existing Pro system.
18. Integrator to coordinate for Mesa County's naming conventions and program each alarm and card reader location accordingly.
19. Upon Mesa County's request, Integrator shall reprogram system one time during the warranty period at no increase in contract price. At no increase in Contract price, the Integrator shall update the system software to the most recent version available at the time of reprogramming during warranty period.

2.05 COMPUTER WORKSTATION / SERVER

- A. Refer to Specification Section 28 23 00 Digital Video System, Common Features for Digital Video System Computers for Computer Workstation and Server requirements.
 1. Workstations are to be provided under the Digital Video System portion of work and the SMS application is to reside of those computers. Coordinate this work with the Digital Video System integrator.
 2. SMS Rack Mount Administrative computer is to be provided and installed by this Contractor.
 3. SMS Server is to be provided and installed by this Contractor.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of electronic security system.
- B. Examine rough-in for embedded and built-in anchors to verify actual locations of intrusion detection connections before electronic security system installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

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3.02 SYSTEM INTEGRATION

- A. Integrate electronic security system with the following systems and equipment:
 - 1. Electronic door hardware.
 - 2. Existing RS2 Access Control System.

3.03 INSTALLATION

- A. Install electronic security system in accordance with manufacturer's written instructions.

END OF SECTION

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SECTION 312000 EARTHWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.02 SECTION INCLUDES:

- A. Construction of excavations and embankments to develop the site to the desired elevations
- B. Preparation of the subgrade for all site concrete and pavement construction
- C. Imported fill
- D. Disposal of excess excavation

1.03 RELATED SECTIONS:

- A. Section 01 33 00 – Submittals.
- B. Section 01 40 00 - Quality Control.
- C. Section 31 22 70 - Temporary Erosion Control.

1.04 REFERENCES

- A. The latest issue of the publications listed below and referenced to thereafter by basic designation only, forms a part of this specification to the extent indicated by the reference thereto:
 - 1. Colorado Department of Transportation Standard Specifications for Road and Bridge Construction.

1.05 DEFINITIONS

- A. Imported fill: Imported fill shall consist of approved material obtained from outside the project limits, required for the construction of the project to develop the desired grades. All imported fill shall be approved by the Geotechnical Engineer and shall be of equal or greater quality than on-site material..
- B. Excess Excavation: On-site material in excess of the amount required to develop the desired elevations. The contractor shall remove and dispose of all excess excavation.
- C. Geotechnical Engineer: The Owner's soil testing service.

1.06 SUBMITTALS:

- A. The Contractor shall submit test results from a certified testing laboratory for all imported soil material. The number in parentheses indicates the number of tests to be submitted from each source.

1.07 QUALITY ASSURANCE

- A. Testing and Inspection Service: The Owner Shall employ and pay for a qualified independent geotechnical testing and inspection laboratory to perform soil testing and inspection service during earthwork operations in accordance to the schedule of frequency in the above referenced specification.

1.08 PROJECT CONDITIONS

- A. Site Information: Data in subsurface investigation reports was used for basis of the design and are available to the Contractor for information only. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings. The Owner will not be responsible for interpretations or conclusions drawn from this data by the Contractor. Additional test borings and other exploratory operations may be performed by the Contractor at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.
- B. Verification of Existing Conditions: Visit the site prior to submission of bids. Verify existing conditions, elevations, and contours. In the event of discrepancies between existing conditions and the requirements of the Contract Documents, contact the Architect for clarification.
- C. Existing Bench Marks: Carefully preserve and maintain existing bench marks, monuments, property line pipes and pins, and other reference points. If disturbed or destroyed, restore or replace at no additional cost to the Owner.

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- D. Existing Utilities: Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.
- E. Utility Service Interruption: Should uncharted, or incorrectly charted piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with the Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility Owner.
 - 1. Do not interrupt existing utilities serving facilities occupied by the Owner or others, during occupied hours, except when permitted in writing by the Architect and then only after acceptable temporary utility services have been provided. Provide a minimum of 48-hour notice to the Architect, and receive written notice to proceed before interrupting any utility.
 - 2. Contact utility locator service for area where Project is located before excavating.
 - 3. Demolish and completely remove from site the existing underground utilities indicated to be removed. Coordinate with utility companies for shutoff of services if lines are active.

PART 3 - EXECUTION

2.01 CONSTRUCTION REQUIREMENTS

- A. All site earthwork including excavations, embankment construction, preparation of subgrade shall conform to Section 203 of the above referenced publication.

END OF SECTION

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SECTION 321216 HOT BITUMINOUS PAVEMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.02 SECTION INCLUDES

- A. Hot bituminous pavements for all work as shown on the plans.
- B. Asphalt patching.
- C. Aggregate base course under all bituminous and concrete pavement areas; and all site curbs, gutters and sidewalks.
- D. Tack coat
- E. Crack Seal
- F. Seal Coat

1.03 RELATED SECTIONS

- A. Section 01 33 00 – Submittals.
- B. Section 01 40 00 - Quality Control.
- C. Section 31 20 00 - Earthwork.
- D. Section 32 13 63 - Pavement Marking.

1.04 REFERENCES

- A. The latest issue of the publications listed below and referenced to thereafter by basic designation only, forms a part of this specification to the extent indicated by the reference thereto:
- B. Colorado Department of Transportation Standard Specifications for Road and Bridge Construction.

1.05 DEFINITIONS:

- A. Aggregate Base Course: All aggregate base course shall meet the requirements for Aggregate Base Course Class 6 of Section 304 of the above referenced specification.
- B. Hot Bituminous Pavement: All hot bituminous pavement shall meet the requirements for Hot Bituminous Pavement, Grading SX, of Section 401 of the above referenced specifications.
- C. Tack Coat: All tack coat shall meet the requirements for cationic emulsified asphalt (CSS-1h) of Section 407 of the above referenced specifications
- D. Crack Seal: All crack sealant material shall meet the requirements of Section 408 of the above referenced specifications.
- E. Seal Coat: All seal coat material shall meet the requirements for Type 1 of Section 409 of the above referenced specifications.

1.06 SUBMITTALS

- A. Submit proposed job mix formula for approval prior to commencement of work for proposed mix design developed using the Superpave mix design method (75 gyrations) in accordance with Section 401.
- B. Submit samples of Aggregate Base Course Class 6 from the proposed source.

1.07 QUALITY ASSURANCE

- A. The Owner shall employ and pay for a qualified independent geotechnical testing and inspection laboratory to perform all material and workmanship testing according to the schedule of frequency in the above referenced specifications.

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PART 2 - NOT USED

PART 3 - EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

- A. The Contractor shall furnish, place and compact all Hot Bituminous Pavement and Aggregate Base Course in accordance with the Sections 304 and 401 of the above referenced specifications.
- B. The Contractor shall furnish and place all Joint and Crack Sealant and Seal Coat in accordance with the Sections 408 and 409 of the above referenced specifications.

3.02 TOLERANCES

- A. Flatness: Maximum variation of 0.25 inches measured with ten (10) foot straightedge.
- B. Scheduled Compacted Thickness: Within 0.25 inch.
- C. Variation from True Elevation: Within 0.10 inch.

3.03 PROTECTION

- A. Immediately after placement, protect pavement from mechanical injury until cooled and hardened.

END OF SECTION

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SECTION 321313 SITE CONCRETE

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. This Section includes exterior cement concrete pavement for the following:
 - 1. Driveways and roadways.
 - 2. Curbs and gutters.
 - 3. Walkways.
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete " for general building applications of concrete.
 - 2. Division 31 Section "Earthwork" for subgrade preparation, grading, and subbase course.
 - 3. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants of joints in concrete pavement and at isolation joints of concrete pavement with adjacent construction.

1.03 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.04 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated, including decorative aggregates.
- B. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Minutes of preinstallation conference.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
 - 1. Before submitting design mixtures, review concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and concrete pavement construction practices. Require representatives, including the following, of each entity directly concerned with concrete pavement, to attend conference:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete producer.
 - d. Concrete pavement subcontractor.
- D. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

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1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2.02 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
 1. Use flexible or curved forms for curves with a radius 100 feet(30.5 m) or less.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.03 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.
- C. Plain Steel Wire: ASTM A 82,[as drawn
- D. Deformed-Steel Wire: ASTM A 496.
- E. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60(Grade 420). Cut bars true to length with ends square and free of burrs.
- F. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:
 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2.04 CONCRETE MATERIALS

- A. Concrete for construction of curbs, gutters, sidewalks, curb ramps, driveway approaches, corner fillets, drainage pans, median cover and trails shall be CDOT Class B modified as follows and shall be designated as Class GV-B (Class B modified for the Grand Valley).
 1. Minimum field compressive strength ----- 4000 psi. at 28 days
 2. Air content ----- 6% ± 1.5%
 3. Maximum water cement ratio -----0.45
 4. Maximum slump at delivery shall be 4". In the event that the concrete slump from the first truck of the day exceeds 5" the load will be rejected.
 5. Subsequent Decorative Aggregates: Washed river run quartz aggregate, maximum size 3/8 inch nominal, blended colors to match Architect's sample.
- B. Water: ASTM C 94/C 94M.
- C. Admixtures:
 1. Calcium chloride shall not be used in any concrete. See Section 711.03 for approved
 2. accelerating admixtures. Concrete shall be made with ASTM C150 Type II Portland Cement

2.05 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd.(305 g/sq. m) dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete. Do not use for decorative exposed aggregate concrete paving.
 1. Products:
 - a. ChemMasters; Spray-Film.
 - b. Conspec Marketing & Manufacturing Co., Inc.; Aquafilm.
 - c. Dayton Superior Corporation; Sure Film.
 - d. Euclid Chemical Company (The); Eucobar.
 - e. L&M Construction Chemicals, Inc.; E-Con.
 - f. Meadows, W. R., Inc.; Sealtight Evapre.
 - g. Sika Corporation, Inc.; SikaFilm.

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2.06 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: [ASTM D 1751, asphalt-saturated cellulosic fiber] .
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to requirements, and as follows:
 - 1. Type IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.07 PAVEMENT MARKINGS

- A. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, with drying time of less than 45 minutes.
 - 1. Color: As indicated .

2.08 WHEEL STOPS

- A. Wheel Stops: Precast, air-entrained concrete, [2500-psi(17.2-MPa)] minimum compressive strength, [4-1/2 inches(115 mm) high by 9 inches(225 mm) wide by 72 inches(1820 mm) long] . Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.
 - 1. Dowels: Galvanized steel, 3/4-inch(19-mm) diameter, 10-inch(254-mm) minimum length.
- B. Wheel Stops: Solid, integrally colored, 96 percent recycled HDPE or commingled postconsumer and postindustrial recycled plastic; UV stabilized; 4 inches(100 mm) high by 6 inches(150 mm) wide by 72 inches(1820 mm) Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.
 - 1. Dowels: Galvanized steel, 3/4-inch(19-mm) diameter, 10-inch(254-mm) minimum length.

2.09 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.
- B. Proportion mixtures to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 4500 psi(31 MPa) .
 - 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45].
 - 3. Slump Limit: 4 inches(100 mm) plus or minus 1 inch(25 mm).
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
 - 1. Air Content: 5 percent plus or minus 1.5 percent for 3/4-inch(19-mm) nominal maximum aggregate size
- D. Limit water-soluble, chloride-ion content in hardened concrete to [0.15] percent by weight of cement.
- E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use plasticizing and retarding admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
- F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements for concrete exposed to deicing chemicals. as follows:
 - 1. Fly Ash or Pozzolan: 25 percent.
 - 2. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

2.10 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.
 - 1. When air temperature is between 85 deg F(30 deg C) and 90 deg F(32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F(32 deg C), reduce mixing and delivery time to 60 minutes.

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PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.
 - 1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph(5 km/h).
 - 2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons(13.6 tonnes).
 - 3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch(13 mm)] require correction according to requirements in Division 31 Section "Earth Moving."
- C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.02 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.03 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.04 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
 - 1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
 - 1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
 - 2. Provide tie bars at sides of pavement strips where indicated.
 - 3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces at areas not subject to vehicle traffic.
 - 4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches(38 mm) into concrete.
 - 5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
 - 1. Locate expansion joints at intervals of , unless otherwise indicated.
 - 2. Extend joint fillers full width and depth of joint.
 - 3. Terminate joint filler not less than 1/2 inch(13 mm) or more than 1 inch(25 mm) below finished surface if joint sealant is indicated.

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4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows to match jointing of existing adjacent concrete pavement:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a $1/4$ -inch(6-mm) radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut $1/8$ -inch-(3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
- E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a $1/4$ -inch(6-mm) radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.05 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery or at Project site.
- F. Do not add water to fresh concrete after testing.
- G. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- H. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
- I. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.
1. Remove and replace concrete that has been placed for more than 15 minutes without being covered by top layer, or use bonding agent if approved by Architect.
- J. Screed pavement surfaces with a straightedge and strike off.
- K. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- L. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.
- M. Slip-Form Pavers: When automatic machine placement is used for pavement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce pavement to required thickness, lines, grades, finish, and jointing as required for formed pavement.
1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.

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- N. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.
- O. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When air temperature has fallen to or is expected to fall below 40 deg F(4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F(10 deg C) and not more than 80 deg F(27 deg C) at point of placement.
 - 2. Do not use frozen materials or materials containing ice or snow.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.
- P. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
 - 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F(32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 - 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.06 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
 - 1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3.07 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h(1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
 - 1. Moist Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch(300-mm) lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches(300 mm), and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.08 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
 - 1. Elevation: 1/4 inch(6 mm).
 - 2. Thickness: Plus 3/8 inch(10 mm), minus 1/4 inch(6 mm).
 - 3. Surface: Gap below 10-foot-(3-m-) long, unleveled straightedge not to exceed 1/4 inch(6 mm).

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4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch(25 mm).
5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch(6 mm).
6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch(13 mm).
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches(6 mm per 300 mm).
8. Joint Spacing: 3 inches(75 mm).
9. Contraction Joint Depth: Plus 1/4 inch(6 mm), no minus.
10. Joint Width: Plus 1/8 inch(3 mm), no minus.

3.09 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow concrete pavement to cure for days and be dry before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils(0.4 mm).

3.10 WHEEL STOPS

- A. Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded in holes drilled or cast into wheel stops at one-quarter to one-third points. Firmly bond each dowel to wheel stop and to pavement. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.11 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage]a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 1. Testing Frequency: Obtain at least 1 composite sample for each 50 cu. yd.(38cu. m) or fraction thereof of each concrete mix placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F(4.4 deg C) and below and when 80 deg F(27 deg C) and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi(3.4 MPa).
- D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as

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directed by Architect.

- G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.12 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.
- B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.
- C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

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SECTION 321373 PAVEMENT JOINT SEALANTS

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. This Section includes the following:
 - 1. Expansion and contraction joints within cement concrete pavement.
- B. Related Sections include the following:
 - 1. Division 07 Section "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.
 - 2. Division 02 Section "Decorative Stamped Concrete Pavement" for constructing joints in concrete pavement.

1.03 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Verification: For each type and color of joint sealant required. Install joint-sealant samples in 1/2-inch-(13-mm-) wide joints formed between two 6-inch-(150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- C. Qualification Data: For Installer .

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.06 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
 - 2. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F(4.4 deg C).
 - 3. When joint substrates are wet or covered with frost.
 - 4. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 5. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.02 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

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- B. Colors of Exposed Joint Sealants: Match Architect's samples .

2.03 COLD-APPLIED JOINT SEALANTS

- A. The following sealants are approved for sealing concrete joints
 1. Sikafix ICSL or 15LM
 2. Dow890SL
 3. Percora 300SL
 4. Spectrem 900SL
 5. Sonalastic SL1

2.04 JOINT-SEALANT BACKER MATERIALS

- A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.
- B. Preformed joint fillers conforming to AASHTO M 153 type IV polyurethane bonded recycled rubber are approved.

2.05 PRIMERS

- A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3- EXECUTION

3.01 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.03 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 1. Do not leave gaps between ends of backer materials.
 2. Do not stretch, twist, puncture, or tear backer materials.
 3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses provided for each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

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3.04 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION

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SECTION 321723 PAVEMENT MARKINGS

PART 1-

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.02 SECTION INCLUDES

- A. The application of traffic paint and reflective media in accordance with the Manual on Uniform Traffic Control Devices - Part III and as modified and supplemented by this Section of these projects Specifications and the Drawings.
- B. All on-site striping words and handicap parking designations shown on plans. Where not shown on plans, handicap designation shall be painted on surface per latest MUTCD standards.

1.03 RELATED SECTIONS

- A. Section 32 12 16- Hot Bituminous Pavement
- B. Section 32 13 13 – Site Concrete.

1.04 REFERENCES

- A. The latest issue of the publications listed below and referenced to thereafter by basic designation only, forms a part of this specification to the extent indicated by the reference thereto:
- B. "Standard Specifications for Road and Bridge Construction," Colorado Department of Transportation, State of Colorado, (CDOT Specs).
 - 1. Section 627 - Pavement Marking.
 - 2. Section 708 - Paints.
 - 3. Section 713 - Traffic Control Materials.

1.05 SUBMITTALS

- A. Pavement Marking Paint:
 - 1. Submit a certification from the manufacturer or an approved independent laboratory that the Pavement Marking Paint used complies with the requirements of Part 2.

1.06 QUALITY ASSURANCE

- A. Paint markings shall not fade, crack, flake or peel within the warranty period.

PART 2 - PRODUCTS

2.01 PAINT

- A. Pigment, Vehicle and Properties: (PT-3) of the finished paint shall meet specifications of Sections 708.01 and 708.05 Paints of the CDOT Specifications.
- B. Glass beads are not required for on-site work.

2.02 COLOR

- A. Color for on-site pavement marking shall be as specified by Architect, or shown on the plans.

PART 3 - EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

- A. Description: Pavement markings shall be applied over the finished asphalt surface of concrete surface. See plans for locations.
- B. Surface Preparation: Dirt, clay, silt and sand will be removed from the pavement prior to the application of paint.
- C. Weather Limitations: No paint shall be applied to damp or wet pavement surfaces, nor when inclement weather threatens to interrupt normal progress of the work. Traffic paints shall not be applied at a surface temperature below 70 degrees F nor exceeding 95 degrees F. During periods of high wind, painting shall

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be discontinued. Interpretation of "inclement weather" and "high wind" will be determined by the Architect/Engineer.

- D. Application: Equipment shall conform to Section 627 - Pavement Marking, CDOT
- E. Paint shall be applied according to Section 627 - Pavement Marking, CDOT.
- F. Pavement Marking: Striping Shall conform to the U.S. Department of Transportation, Manual on Uniform Traffic Control Devices, (MUTCD).
- G. Beneficial Occupancy: Newly painted surfaces shall be protected from damage by vehicles during the time required for paint to harden sufficiently to prevent displacement or pickup by tires of automobile traffic. If paint has not hardened sufficiently in 90 minutes, painting operations shall cease until the reason for slow drying has been corrected.

3.02 HANDICAP PARKING DESIGNATION

- A. Provide international symbols for handicap parking painted in white graphic with blue color background.

3.03 PAINTED YELLOW ISLANDS

- A. Spacing shall be 24 inches.
- B. Lines shall be painted at a 45 degree angle.
- C. Yellow stripe shall be 4 inches wide.

3.04 CROSSWALKS:

- A. Pavement marking material shall be paint.

END OF SECTION