



PROJECT MANUAL

PROJECT:

SALEM AVENUE SENIOR COMMUNITY

**1038 SALEM AVE.
DAYTON OHIO 43215**

OWNER:

**NATIONAL CHURCH RESIDENCES
5475 RINGS ROAD, SUITE 300
DUBLIN, OH 43017**

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Salem Avenue Senior Community
Dayton, Ohio 43215

Comm. #2025-21
pH7 Architects

PROJECT # 2025-21
1/15/2025

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SECTION 01 00 00 - GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY:

- A. Work performed shall comply with the following, but not limited to:
 - 1. The 2024 Ohio Building Code (O.B.C.).
 - 2. All applicable local and State codes, Life Safety, NFPA 101, ordinances and regulations.
 - 3. The owner is responsible for obtaining and paying permits relating to the general building permit and any tap fees. The Owner/Architect will apply for the building permit after the bid process.
 - 4. The subcontractors (such as sprinkler, fire alarm, plumbing, etc.) are responsible for obtaining and paying for required permits and fees as required for the local jurisdiction.
 - 5. The Contractor should be responsible to paying for any contractor licensing requirements and re-inspection fees.

1.3 VERIFICATION

- A. Verification of all dimensions and conditions shall be the responsibility of the Contractor and his Sub-Contractors. Noted no hand scaling should be done in the field. The Contractor to request clarification from the Architect.

1.4 DISCREPANCIES

- A. The Contractor shall compare and coordinate all drawings and verify all dimensions. When in the opinion of the Contractor a discrepancy exists, he/she shall promptly report it to the Architect for proper adjustment before proceeding with the work.
- B. The general notes and typical details apply throughout the job unless otherwise noted or shown.
- C. In the event certain elements of the construction are not fully shown on the drawings, construction shall match existing features (if applicable) and be of the same character throughout the project. Notify the Architect during the bidding process if additional information is required. Construction shall include all service connections required for a complete and operational product or system. When existing items are removed in order to accommodate the new construction, items which can be reused at a savings to the Owner are to be identified and referred to the Architect for action as to potential use in the project.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 SAFE USE OF PRODUCTS

- 1. All manufacturer's and fabricators printed warnings for handling of products must be strictly observed.

3.2 FIRE RESISTANCE ASSEMBLIES

- A. See the Appendix for reference of the listed assemblies in the Construction Documents.

END OF SECTION

SECTION 01 10 00 - SUMMARY

PART 1 GENERAL

1.1 PROJECT IDENTIFICATION

- A. PROJECT NAME: Salem Avenue Senior Community, located at:
 - 1038 Salem Ave..
 - Dayton, Ohio 43215.
- 1. Architect's Project Number: 2025-21.
- B. OWNER:
 - 1. Name: National Church Residences
 - a. Address Line 1: 5475 Rings Rd..
 - b. Address Line 2: Suite 300.
 - c. City: Dublin.
 - d. State: Ohio.
 - e. Zip Code: 43017.
 - f. Telephone: 800-388-2151.
 - 2. Primary Contact: All correspondence from the Contractor to the Architect will be direct, with copies to this party, unless alternate arrangements are mutually agreed upon at preconstruction meeting.
 - 3. Primary Contact:
 - a. Title: Senior Director of Pre-Construction.
 - b. Name: Jon Holway.
 - c. Email: JHolway@nationalchurchresidences.org.
- C. ARCHITECT
 - 1. Company Name: pH7 Architects.
 - a. Address Line 1: 448 W. Nationwide Blvd.
 - b. Address Line 2: Loft 100.
 - c. City: Columbus.
 - d. State: Ohio.
 - e. Zip Code: 43215.
 - f. Telephone: 614-459-2955.
 - g. Website: www.ph7architects.com.
 - 2. Architect: Design Professional of Record. All correspondence from the Contractor regarding construction documents authored by Architect's consultants will be through this party, unless alternate arrangements are mutually agreed upon at preconstruction meeting.
 - 3. Primary Contact:
 - a. Title: Project Executive.
 - b. Name: Ian Andersen.
 - c. Email: iandersen@ph7architects.com.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
 - 1. A new 75 unit affordable apartment building. The building is three stories high and is wood framed in type VA construction over slab on grade. The exterior is clad in manufactured stone and fiber cement siding and trim. The roof will be asphalt shingles with some low sloped EPDM. .
- B. Type of Contract.
 - 1. Project will be constructed under a single prime contract.
- C. ACCESS TO SITE
 - 1. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

D. WORK RESTRICTIONS

1. Work Restrictions, General: Comply with restrictions on construction operations.
 - a. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
2. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet (8 m) of entrances, operable windows, or outdoor-air intakes.
3. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

E. SPECIFICATION AND DRAWING CONVENTIONS

1. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - a. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - b. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
2. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
3. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 - a. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - b. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
 - c. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 20 00 - APPLICATIONS FOR PAYMENT

PART 1 GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.
- B. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule, List of Subcontracts, and Submittal Schedule.
- C. The Contractor's Construction Schedule and Submittal Schedule are included in Section "Submittals".

1.2 SCHEDULE OF VALUES

- A. Use Schedule of Values Form: AIA G703, edition stipulated in the Agreement.
- B. Submit Schedule of Values within 15 days after the Owner-Contractor Agreement.
- C. Coordinate preparation of the Schedule of Values with the Contractor's Construction Schedule.
- D. Correlate line items in the Schedule of Values with other schedules and forms, including:
 - 1. Contractor's Construction Schedule.
 - 2. Application for Payment form.
 - 3. List of subcontractors.
 - 4. List of products.
 - 5. List of principal suppliers and fabricators.
 - 6. Schedule of submittals.
 - a. Submit the Schedule of Values to the Architect at the earliest date.
 - b. Format and Content: Use the Cost Development Spread Sheet as a guide to establish the format.
 - 1) Identification: Include the following identification:
 - a) Project name and location.
 - b) Name of the Architect.
 - c) Project number.
 - d) Contractor's name and address.
 - e) Date of submittal.
 - c. Break Contract Sum down in enough detail to facilitate evaluation of Applications for Payment. Break subcontract amounts down into logical material or installation line items. Round amounts off to the nearest dollar; the total shall equal the Contract Sum.
 - d. Show line items for indirect costs, and margins on costs, to extent that such items will be listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete including total cost and share of overhead and profit.
 - e. Temporary facilities and items that are not direct cost of Work-in-place may be shown as separate line items or distributed as general overhead expense.
 - f. Change Orders will be listed as a separate line item on the Schedule of Values.

1.3 APPLICATIONS FOR PAYMENT:

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect and paid for by the Owner.
- B. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.
- C. Payment Application Times: Each progress payment date is as indicated in the Agreement. The period of construction Work covered by each Application or Payment is the period indicated in the Agreement.

- D. Payment Application Forms: Use AIA Document G702 and Continuation Sheets G703 as the form for the application or other form acceptable to Owner and Architect.
- E. Application Preparation: Complete every entry, including notarization and execution by person authorized to sign on behalf of the Owner. Incomplete applications will be returned without action.
- F. Entries shall match data on the Schedule of Values.
- G. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the period covered by the application.
- H. Waivers of Mechanics Lien: With each Application for Payment submit waivers of mechanics liens from subcontractors or subcontractors and suppliers for the construction period covered by the previous application.
 - 1. Submit partial waivers on each item for amount requested.
 - 2. When an application shows completion of an item, submit final or full waivers.
 - 3. The Owner reserves the right to designate which entities involved in the Work must submit waivers.
 - 4. Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to Owner.
- I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include:
 - 1. Schedule of Values.
 - 2. Contractor's Construction Schedule (preliminary if not final).
 - 3. Submittal Schedule (preliminary if not final).
 - 4. Copies of building permits.
 - 5. Copies of licenses from governing authorities.
 - 6. Certificates of insurance and insurance policies.
 - 7. Bonds if required by the owner.
- J. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions. Administrative actions and submittals that precede or coincide with this application include:
 - 1. Occupancy permits and similar approvals.
 - 2. Warranties (guarantees) and maintenance agreements.
 - 3. Test/adjust/balance records.
 - 4. Maintenance instructions.
 - 5. Meter readings.
 - 6. Change-over information related to Owner's occupancy, use, operation and maintenance.
 - 7. Final cleaning.
 - 8. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.
- K. Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of the final payment application include:
 - 1. Evidence of completion of Project closeout requirements.
 - 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 - 3. Updated final statement, accounting for final changes to the Contract Sum.
 - 4. AIA Document G706-1994, "Contractor's Affidavit of Payment of Debts and Claims."
 - 5. AIA Document G706A-1994, "Contractor's Affidavit of Release of Liens."
 - 6. AIA Document G707-1994, "Consent of Surety to Final Payment."
 - 7. Evidence that claims have been settled.
 - 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 - 9. Final liquidated damages settlement statement.

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PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01 20 50 - MODIFICATION PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

- A. This section specifies administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. "Submittals" for requirements for the Contractor's Construction Schedule.
 - 2. 01 20 00 - APPLICATIONS FOR PAYMENT for administrative procedures governing applications for payment.
 - 3. Division 0 Section "Product Substitutions" for administrative procedures for handling requests for substitutions made after award of the Contract.

1.2 MINOR CHANGES IN THE WORK

- A. Supplemental instructions authorizing minor changes in the Work, not involving an adjustment to the Contract Sum or Contract Time, will be issued by the Architect on AIA form G708, Architect's Field Order.

1.3 CHANGE ORDER PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time will be issued by the Owner Representative, and facilitated by the Architect as Bulletins, with a detailed description of the proposed change and supplemental or revised Drawings and Specifications, if necessary.
- B. Proposal requests issued by the Architect are for information only. Do not consider information given as formal instruction to either to stop work in progress, or to execute the proposed change.
- C. Unless otherwise indicated in the proposal request, within 10 days of receipt of the proposal request, submit for Owner's review an estimate of cost necessary to execute the proposed change.
- D. Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
- E. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
- F. Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.
- G. Contractor-Initiated Change Order Proposal Requests: When latent or other unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect.
- H. Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.
- I. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
- J. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
- K. Comply with requirements in Section "Product Substitutions" if the proposed change in the Work requires the substitution of one product or system for a product or system specified.

1.4 CHANGE ORDER PROCEDURES

- A. Upon the Owner's approval of a Change Order Proposal Request, the Architect will issue a Change Order for signatures of the Owner, Architect and Contractor on the form that shall be provided by the Architect.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01 21 00 - ALLOWANCES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements governing allowances.
- B. Types of allowances include the following:
 - 1. Lump-sum allowances.
 - 2. Unit-cost allowances.
 - 3. Contingency allowances.
- C. Related Requirements:
 - 1. Section 01 22 00 "Unit Prices" for procedures for using unit prices.
 - 2. Section 01 40 00 "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.

1.2 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Architect from the designated supplier.

1.3 ACTION SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

1.4 INFORMATIONAL SUBMITTALS

- A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 COORDINATION

- A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6 LUMP-SUM ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, to Project site.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner under allowance shall be included as part of the Contract Sum and not part of the allowance.
- C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.7 CONTINGENCY ALLOWANCES

- A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.
- B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.
- C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit margins.
- D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.8 ADJUSTMENT OF ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
 1. Include installation costs in purchase amount only where indicated as part of the allowance.
 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
 3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
 4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.
 1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
 2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

- A. Allowance No. 01 - Brick Masonry: Lump-Sum Allowance: Provide a unit cost allowance of \$450 per thousand brick. As specified in Section 04 20 00 "Unit Masonry".

1. This allowance includes the material cost.

END OF SECTION

SECTION 01 22 00 - UNIT PRICES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Requirements:
 - 1. Section 01 20 50 "Modification Procedures" for procedures for submitting and handling Change Orders.

1.2 DEFINITIONS

- A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.3 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 SCHEDULE OF UNIT PRICES

- A. Unit Price No. __ – __:
 - 1. Description: __ according to Section __.
 - 2. Unit of Measurement: __.
 - 3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 01 21 00 "Allowances."

END OF SECTION

SECTION 01 23 00 - ALTERNATES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Alternate No. ____.
 - 1. Base Bid: _____.
 - 2. Alternate: _____.

END OF SECTION

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.1 DEFINITIONS

- A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
 - 1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
 - 2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 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. Bear the costs engendered by proposed substitution of:
 - a. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
 - b. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request.
- B. A Substitution Request for specified installer constitutes a representation that the submitter:
 - 1. Has acted in good faith to obtain services of specified installer, but was unable to come to commercial, or other terms.
- C. 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.
 - 2. Conditions: The Contractor's substitution request will be received and considered by the Owner Representative & Architect when one or more of the following conditions are satisfied, as determined by the Owner Representative & Architect; otherwise requests will be returned without action except to record noncompliance with these requirements.
 - a. Extensive revisions to Contract Documents are not required.
 - b. Proposed changes are in keeping with the general intent of Contract Documents.
 - c. The request is timely, fully documented and properly submitted.
 - d. The request is directly related to an "or equal" clause or similar language in the Contract Documents.
 - e. The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
 - f. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
 - g. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be

required to bear. Additional responsibilities for the Owner may include additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.

- h. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.
- i. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.
- j. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provides the required warranty.

3.2 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.

3.3 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

- A. 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.
- B. 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.
 - 2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
- C. Substitutions will not be considered under one or more of the following circumstances:
 - 1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
 - 2. Without a separate written request.

3.4 SUBMITTALS

- A. 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. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
- C. Limit each request to a single proposed substitution item.
 - 1. Submit an electronic document, combining the request form with supporting data into single document.
- D. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
 - 1. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.
 - 2. Samples, where applicable or requested.
 - 3. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.

4. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors that will become necessary to accommodate the proposed substitution.
5. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
6. Cost information, including a proposal of the net change, if any in the Contract Sum.
7. Certification by the Contractor that the substitution proposed is an equal too or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.
8. Architect's Action: Within one week of receipt of the request for substitution, the Architect will request additional information or documentation if necessary for evaluation of the request.
 - a. Within 2 weeks of receipt of the request, or one week of receipt of the additional information or documentation, which ever is later, the Architect will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name. Acceptance will be in the form of a Change Order.

3.5 RESOLUTION

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

3.6 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.
- B. The Contractor's submittal and Architect's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.

3.7 ATTACHMENTS

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

END OF SECTION

SECTION 01 25 01 - SUBSTITUTION SHEET

REQUEST No. _____

REFER TO "SUBSTITUTIONS", IN THE INSTRUCTIONS TO BIDDERS AND SECTION 01 25 00 REGARDING THE USE OF MATERIALS OR METHODS OTHER THAN "STANDARDS".

BIDDER/CONTRACTOR IS TO LIST HERE ANY "SUBSTITUTIONS" FOR WHICH CONSIDERATION IS DESIRED.

BRAND OR MAKE SPECIFIED:

PROPOSED SUBSTITUTION:

COST CHARGE / DEDUCT TO USE PROPOSED SUBSTITUTION:

CONTRACTOR'S REASON FOR PROPOSING SUBSTITUTION:

IT IS UNDERSTOOD AND AGREED THAT THE PROPOSAL SUBMITTED IS BASED ON FURNISHING ONLY APPROVED ITEMS AND ENTITLES THE OWNER TO REQUIRE THAT SUCH NAMED MATERIALS AND METHODS BE INCORPORATED IN THE WORK.

SIGNED: _____

Salem Avenue Senior Community
Dayton, Ohio 43215

Comm. #2025-21
pH7 Architects

BIDDER / CONTRACATOR

DATE

WAIVER AGREEMENT FOR USE OF ELECTRONIC DESIGN FILES

Project Name: PH7 Master
Client: XYZ Corporation

- A) The undersigned acknowledges receipt of associated electronic formatted files including, but not limited to; REVIT/CAD, PDF and or JPEG files for the above referenced project. The user agrees that these files are for uses related to the above project only and that files and the information contained within are the property of pH7 Architects, Inc. and XYZ Corporation. This information may not be reproduced or used in any format except in conjunction with the above project.
- B) The Drawings, Specifications and other documents, or data prepared by pH7 Architects, Inc. are to be used solely for the purpose of executing the construction of the new facility on this site. It shall not be used for the construction of other projects on other sites.
- C) The user acknowledges that the information provided in these files is not a substitution or replacement for the official Contract Documents. The user acknowledges that pH7 Architects, Inc., its consultants or the project owner, make any warranty or representation that the information contained in these files reflect the final contract Documents as information may be added through other media or tools which may not translate to the electronic file(s) being provided.
- D) The user assumes full responsibility in the use of these files. Confirmation that all manual modifications -- Addenda, Bulletins, Clarifications and Change Orders to the Project drawings executed as a part of the Contract Documents or from As-Built Information shall fall on the responsibility of the user of these files. The user acknowledges that the Contract Documents for this project are the dated, signed, and sealed hard copy, of drawings and specifications. If a conflict exists between the electronic file and hard copies, the hard copies shall take precedence. The user agrees to the fullest extent permitted by law to indemnify and hold harmless pH7 Architects, Inc., against any claims resulting from the use of the provided electronic files.
- E) Supply of electronic data or other items shall not in any manner change or alter the requirements of any Contract or Subcontract Documents, or the responsibilities or liabilities of the Contractor(s) or user.
- F) The Drawings, Specifications and other documents of data prepared by pH7 Architects, Inc. are instruments of pH7 Architects, Inc.'s service. The user shall not own or claim a copyright in the Drawings, Specifications and other documents or data prepared by pH7 Architects, Inc. pH7 Architects, Inc. shall be deemed the author of the Contract Documents and will retain all common law, statutory and other reserved rights, in addition to the copyright.
- G) Any data or documents used (other than for general building permit) shall not include or use pH7 Architects, Inc.'s name except as otherwise agreed upon in writing.
- H) This Agreement represents the entire agreement between User and pH7 Architects, Inc. with respect to items provided herein and shall supersede any prior negotiations, representations or agreements, either written or oral. This Agreement may be amended only by written instrument signed by both pH7 Architects, Inc. and user. Nothing in this Agreement shall create a contractual relationship with, or duties, obligations, or causes of action in favor of any third party against either Owner or pH7 Architects, Inc.
- I) This agreement shall be governed by the laws of the State of Ohio. The person signing below represents that he/she has full authority to bind the user.

User: _____

Signed: _____

Title: _____

Date: _____

Files transmitted:

REQUEST FOR INFORMATION

RFI NO. _____

Project: **Ph7 Master Project Number**

RFI DESCRIPTION: (Fully Describe the question or type of information requested)

1.

SUBMITTER'S RECOMMENDATION: (Provide Recommended Solution, including indication of cost or schedule considerations)

1.

SUBMITTED: _____ **DATE:** _____

COMPANY: _____ **PHONE/FAX/EMAIL:** _____

RFI RESPONSE:

DATE: _____

1.

BY: _____
pH7 Architects/Representative

Note: This reply is not an authorization to proceed with work involving additional cost, time or both. If any reply requires a change to the Contract Documents, a Change Order, Construction Change Directive or a Minor Change in the Work must be executed in accordance with the

Salem Avenue Senior Community
Dayton, Ohio 43215

Comm. #2025-21
pH7 Architects

Contract Documents.

SECTION 01 31 00 - PROJECT MEETINGS

PART 1 GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements for project meetings including but not limited to:
 - 1. Pre-Construction Conference.
 - 2. Pre-Installation Conferences.
 - 3. Coordination Meetings.
 - 4. Owner/Architect/Contractor Progress Meetings.

1.2 GENERAL

- A. Schedule and conduct conferences at Project site, unless otherwise indicated.
 - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 - 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect/representative, within 3 days of the meeting.

1.3 PRE-CONSTRUCTION CONFERENCE Contractor, shall Schedule and Conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 30 days after execution of the Agreement.

- A. Contractor, shall Schedule and Conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 30 days after execution of the Agreement.
- B. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
- C. Agenda: Discuss items of significance that could affect progress, including the following:
 - 1. Tentative construction schedule.
 - 2. Phasing.
 - 3. Critical work sequencing and long-lead items.
 - 4. Designation of key personnel and their duties.
 - 5. Procedures for processing field decisions and Change Orders.
 - 6. Procedures for RFIs.
 - 7. Procedures for testing and inspecting.
 - 8. Procedures for processing Applications for Payment.
 - 9. Distribution of the Contract Documents.
 - 10. Submittal procedures.
 - 11. Sustainable design requirements.
 - 12. Preparation of record documents.
 - 13. Use of the premises and existing building (coordinate with owner).
 - 14. Work restrictions.
 - 15. Working hours.
 - 16. Owner's occupancy requirements.
 - 17. Responsibility for temporary facilities and controls.
 - 18. Procedures for moisture and mold control.
 - 19. Procedures for disruptions and shutdowns.
 - 20. Construction waste management and recycling.

21. Parking availability.
22. Office, work, and storage areas.
23. Equipment deliveries and priorities.
24. First aid.
25. Security.
26. Progress cleaning.

- D. Minutes: Contractor shall be responsible for conducting meeting will record and distribute meeting minutes.

1.4 PRE-INSTALLATION CONFERENCES

- A. Conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction.
- B. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, and Owner's Commissioning Authority of scheduled meeting dates.
- C. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
1. Contract Documents.
 2. Options.
 3. Related RFIs.
 4. Related Change Orders.
 5. Purchases.
 6. Deliveries.
 7. Submittals.
 8. Review of mockups.
 9. Possible conflicts.
 10. Compatibility problems.
 11. Time schedules.
 12. Weather limitations.
 13. Manufacturer's written recommendations.
 14. Warranty requirements.
 15. Compatibility of materials.
 16. Acceptability of substrates.
 17. Temporary facilities and controls.
 18. Space and access limitations.
 19. Regulations of authorities having jurisdiction.
 20. Testing and inspecting requirements.
 21. Installation procedures.
 22. Coordination with other work.
 23. Required performance results.
 24. Protection of adjacent work.
 25. Protection of construction and personnel.
- D. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
- E. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
- F. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

1.5 CONTRACTOR COORDINATION MEETINGS

- A. Conduct progress meetings at weekly intervals.

- B. Architect/Representative shall be available by phone conference as needed.

1.6 OWNER/ARCHITECT/CONTRACTOR (OAC) PROJECT MEETINGS

- A. Conduct Project progress meetings at monthly intervals- including Construction Administrators.
- B. Attendees: In addition to representatives of Owner and Owner's Commissioning Authority, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
- C. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
- D. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1. Review schedule for next period.
 - 2. Review present and future needs of each entity present, including the following:
 - a. Interface requirements.
 - b. Sequence of operations.
 - c. Status of submittals.
 - d. Deliveries.
 - e. Off-site fabrication.
 - f. Access.
 - g. Site utilization.
 - h. Temporary facilities and controls.
 - i. Progress cleaning.
 - j. Quality and work standards.
 - k. Status of correction of deficient items.
 - l. Field observations.
 - m. Status of RFIs.
 - n. Status of proposal requests.
 - o. Pending changes.
 - p. Status of Change Orders.
 - q. Pending claims and disputes.
 - r. Documentation of information for payment requests.
- E. Minutes: Contractor shall be responsible for conducting the meeting will record and distribute the meeting minutes no later than 3 days after each progress meeting date to each party present and to parties requiring information.
 - 1. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01 31 50 - SUBMITTALS

PART 1 GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements for submittals required for performance of the Work, including:
 - 1. Submittal schedule.
 - 2. Shop Drawings.
 - 3. Product Data.
 - 4. Samples.

PART 2 PRODUCTS (NOT APPLICABLE).

PART 3 EXECUTION

3.1 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

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

3.2 SUBMITTAL SCHEDULE

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

2. Format schedule to allow tracking of status of submittals throughout duration of construction.
3. Arrange information to include scheduled date for initial submittal and specification number and title.
4. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.

3.3 SUBMITTAL PROCEDURES

- A. Coordination: Contractor shall coordinate preparation and processing of submittals with performance of construction activities.
- B. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
- C. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.
- D. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals
 1. until related submittals are received.
- E. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals.
- F. Allow 10 working days for reprocessing each submittal.
- G. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.
- H. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
- I. Provide a space approximately 3" x 5" on the label or beside the title block on Shop Drawings to record the Construction Manager's review and approval markings and the action taken.
 1. Include the following information on the label for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name and address of Contractor.
 - e. Name and address of subcontractor.
 - f. Name and address of supplier.
 - g. Name of manufacturer.
 - h. Number and title of appropriate Specification Section.
 - i. Drawing number and detail references, as appropriate.
- J. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to CM using a transmittal form. Submittals received from sources other than the Contractor will be returned without action.
 1. On the transmittal record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

3.4 SHOP DRAWINGS

- A. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings. The Contractor shall verify all dimensions and co-ordinate with other trades to assure fit of all required components within the structure.

- B. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:
 - 1. Dimensions.
 - 2. Identification of products and materials included.
 - 3. Compliance with specified standards.
 - 4. Notation of coordination requirements.
 - 5. Notation of dimensions established by field measurement.
 - 6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2"x 11" but no larger than 30" x 42".
 - 7. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.

3.5 PRODUCT DATA

- A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawings."
- B. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:
 - 1. Manufacturer's printed recommendations.
 - 2. Compliance with recognized trade association standards.
 - 3. Compliance with recognized testing agency standards.
 - 4. Application of testing agency labels and seals.
 - 5. Notation of dimensions verified by field measurement.
 - 6. Notation of coordination requirements.
- C. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
- D. Contractor shall distribute shop drawings to all subcontractors after approval.

3.6 SAMPLES

- A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture and pattern.
- B. Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Prepare Samples to match the Architect's Sample. Include the following:
 - 1. Generic description of the Sample.
 - 2. Sample source.
 - 3. Product name or name of manufacturer.
 - 4. Compliance with recognized standards.
 - 5. Availability and delivery time.
- C. Submit Samples for review of kind, color, pattern, and texture, for a final check of these characteristics with other elements, and for a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
- D. Where variation in color, pattern, texture or other characteristics are inherent in the material or product represented, submit multiple units (not less than 3), that show approximate limits of the variations.
- E. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques and details of assembly, connections, operation and similar construction characteristics.

- F. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit 2 sets; one will be returned marked with the action taken. Maintain sets of Samples, as returned, at the Project site, for quality comparisons throughout the course of construction.
- G. Sample sets may be used to obtain final acceptance of the construction associated with each set.
- H. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.
- I. Field Samples specified in individual Sections are special types of Samples. Field Samples are full-size examples erected on site to illustrate finishes, coatings, or finish materials and to establish the standard by which the Work will be judged.
- J. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

3.7 ARCHITECT'S/DESIGN CONSULTANT'S ACTION

- A. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Architect will review each submittal, mark to indicate action taken, and return promptly.
- B. Compliance with specified characteristics is the Contractor's responsibility.
- C. Action Stamp: The Architect/Engineer will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:
 - 1. Approved: Where submittals are marked "Approved," that part of the Work covered by the submittal may precede provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
 - 2. Approved as noted: When submittals are marked "Approved as Noted," that part of the Work covered by the submittal may precede provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.
 - 3. Rejected - Revise and Resubmit: When submittal is marked "Rejected, Revise and Resubmit," do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.
 - a. Do not permit submittals marked "Rejected, Revise and Resubmit" to be used at the Project site, or elsewhere where Work is in progress.
 - 4. Other Action: Where a submittal is primarily for information or record purposes, special processing or other activity, the submittal will be returned, marked "Reviewed and or Action Not Required".

END OF SECTION

SECTION 01 45 00 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 2. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner or authorities having jurisdiction are not limited by provisions of this Section.

1.2 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Preconstruction Testing: Tests and inspections performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- D. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- E. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade or trades.
- I. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of 5 previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.4 INFORMATIONAL SUBMITTALS

- A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems.
 - 1. Seismic-force resisting system, designated seismic system, or component listed in the designated seismic system quality assurance plan prepared by the Architect.
 - 2. Main wind-force resisting system or a wind-resisting component listed in the wind-force-resisting system quality assurance plan prepared by the Architect.
- B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

1.5 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following: NOTE: Owner requests that any concrete pour under 25 yards does not require testing.
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on retesting and re-inspecting.
- B. Manufacturer's Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:
 - 1. Name, address, and telephone number of representative making report.
 - 2. Statement on condition of substrates and their acceptability for installation of product.
 - 3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 - 4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 5. Other required items indicated in individual Specification Sections.
- C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

- B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations, pertaining to, but not limited to the following:
 - 1. Temporary sheeting, shoring, or supports.
 - 2. Temporary scaffolding.
 - 3. Temporary bracing.
 - 4. Temporary falsework for support of spanning or arched structures.
 - 5. Temporary foundation underpinning.
 - 6. Temporary stairs or steps required for construction access only.
 - 7. Temporary hoist(s) and rigging.

1.7 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. Submit a Request for Interpretation to Architect if the criteria indicated are not sufficient to perform required design services.
- C. Scope of Contractor's Professional Design Services: Provide for the following items of work:
 - 1. Structural Design of Wood Trusses: As described in Section 06 17 53 - Shop-Fabricated Wood Trusses
 - 2. System Design: Coordinate with ceiling installation, detailed pipe layout, and hydraulic calculations as described in Section 21 13 00 - Fire-Suppression Sprinkler Systems.
 - 3. System Design: As described in Section 28 46 00 - Fire Alarm Systems.

1.8 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329 and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

- H. Manufacturer's Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Contractor's Quality Control (CQC) Plan:
 - 1. Prior to start of work, submit a comprehensive plan describing how contract deliverables will be produced. Tailor CQC plan to specific requirements of the project. Include the following information:
 - a. Management Structure: Identify personnel responsible for quality. Include a chart showing lines of authority.
 - b. Management Approach: Define, describe, and include in the plan specific methodologies used in executing the work.
 - 1) Management and control of documents and records relating to quality.
 - 2) Coordination procedures.
 - 3) Resource management.
 - 4) Inspection and testing procedures and scheduling.
 - 5) Control of noncomplying work.
 - 6) Tracking deficiencies from identification, through acceptable corrective action, and verification.
 - c. Owner will not make a separate payment for providing and maintaining a Quality Control Plan. Include associated costs in Bid price.
- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
 - d. When testing is complete, remove test specimens, assemblies, mockups. Do not reuse products on Project.
 - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

1.9 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 - 2. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
 - 1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 - 2. Notify testing agencies at least 36 hours in advance of time when Work that requires testing or inspecting will be performed.
 - 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 - 4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 - 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

- C. Manufacturer's Field Services: Where indicated, engage a manufacturer's representative to observe and inspect the Work. Manufacturer's representative's services include examination of substrates and conditions, verification of materials, inspection of completed portions of the Work, and submittal of written reports.
- D. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 - 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 - 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 - 5. Do not releases, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 - 6. Do not perform any duties of Contractor.
- F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. Delivery of samples to testing agencies.
 - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.10 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner and as follows:
 - 1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
 - 2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 - 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
 - 4. Submitting a final report of special tests and inspections at Substantial Completion, this includes a list of unresolved deficiencies.
 - 5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 - 6. Retesting and re-inspecting corrected work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 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.

3.2 MOCK-UPS

- A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
- B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
- C. Integrated Exterior Mock-ups: Construct integrated exterior mock-up as indicated on drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.
- D. Room Mock-ups: Construct room mock-ups as indicated on drawings. Coordinate installation of materials, products, and assemblies as required in specification sections; finish according to requirements. Provide required lighting and any supplemental lighting where required to enable Architect to evaluate quality of the mock-up.
- E. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.
- F. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- G. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- H. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
 - 1. Architect will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up.
 - 2. Make corrections as necessary until Architect's approval is issued.
- I. Architect will use accepted mock-ups as a comparison standard for the remaining Work.
- J. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

3.3 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes requirements for support facilities, and security and protection facilities.

1.2 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.

1.3 INFORMATIONAL SUBMITTALS

- A. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
- B. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire prevention program.

1.4 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in ICC/ANSI A117.1.

1.5 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 PRODUCTS

2.1 TEMPORARY FACILITIES

- A. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project Meetings specified in other Division 01 Sections. Keep office clean and orderly.
- B. When permanent facilities are enclosed with operable utilities, relocate offices into building, with written agreement of Owner, and remove temporary buildings.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

2.2 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 2. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 01 77 00 "Closeout Procedures". Replace filters used during construction with new.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
 - 1. Locate facilities to limit site disturbance as specified in Section 01 10 00 "Summary."
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- E. Heating: Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- G. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
- H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.

2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
 - B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
 1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
 - C. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
 1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
 2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Section 31 20 00 "Earth Moving."
 3. Recondition base after temporary use, including removing contaminated material, regrading, proof rolling, compacting, and testing.
 4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Section 32 12 16 "Asphalt Paving."
 - D. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 2. Maintain access for fire-fighting equipment and access to fire hydrants.
 - E. Parking: Provide temporary parking areas for construction personnel.
 - F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
 1. Identification Signs: Provide Project identification signs as indicated on Drawings.
 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 3. Maintain and touchup signs so they are legible at all times.
 - G. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 73 00 "Execution."
 - H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION
- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
 - B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
 - C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings.
 - D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

- E. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.
- F. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- G. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- H. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.
- I. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.
 - 1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
 - 2. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
 - 3. Insulate partitions to control noise transmission to occupied areas.
 - 4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
 - 5. Protect air-handling equipment.
 - 6. Provide walk-off mats at each entrance through temporary partition.
- J. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire prevention program.
 - 1. Prohibit smoking in construction areas.
 - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 - 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 - 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.

2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

END OF SECTION

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. General product requirements.\
- B. Build America, Buy America Act (BABA) Requirements.
- C. Re-use of existing products.
- D. Transportation, handling, storage and protection.
- E. Product option requirements.
- F. Substitution limitations.
- G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.2 RELATED REQUIREMENTS

- A. Section 01 25 00 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
- B. Section 01 40 00 - Quality Requirements: Product quality monitoring.
- C. This Project is funded in whole or in part by the U.S. Department of Housing and Urban Development (HUD) and is subject to the Build America, Buy America Act (BABA) requirements, including applicable HUD implementation guidance. Requirements apply to all iron and steel products, manufactured products, and construction materials incorporated into the Work, except where a written waiver or statutory exception has been approved by HUD.
 - 1. Where conflicts occur, BABA requirements shall govern over individual specification sections, product data, or supplier representations.
 - 2. Definitions for "iron or steel products," "manufactured products," "construction materials," and "produced in the United States" shall be as defined by HUD BABA guidance in effect at the time of procurement.

1.3 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. Submit BABA Compliance Documentation for each applicable product, including:
 - 1. Manufacturer certification of U.S. production.
 - 2. Identification of manufacturing location(s).
 - 3. Iron/steel mill certifications where applicable.
 - 4. Component cost certification for manufactured products when required.
 - 5. Submittals shall accompany product shop drawings and shall be approved prior to procurement.

PART 2 PRODUCTS

2.1 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. See Section 01 40 00 - Quality Requirements, for additional source quality control requirements.

2.2 PRODUCT OPTIONS

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

2.3 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

3.1 SUBSTITUTION LIMITATIONS

- A. See Section 01 25 00 - Substitution Procedures.
- B. Substitution requests shall include full BABA compliance documentation. Substitutions that reduce or compromise compliance will not be approved.
- C. Waivers or exceptions shall be requested only by the Owner through HUD. The Architect is not authorized to approve BABA waivers.

3.2 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.

3.3 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 74 19.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- G. Comply with manufacturer's warranty conditions, if any.
- H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- I. Prevent contact with material that may cause corrosion, discoloration, or staining.
- J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

3.4 RECORD KEEPING AND CLOSEOUT

END OF SECTION

SECTION 01 73 00 - PROJECT CLOSEOUT

PART 1 GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:
 - 1. Test Results.
 - 2. Project Record Document Submittal.
 - 3. Operating and Maintenance Manual Submittal.
 - 4. Submittal of Warranties.
 - 5. Final Cleaning.
 - 6. Closeout Requirements for specific construction activities are included in the appropriate Sections in Divisions 2 through 28.

1.2 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.
- B. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
 - 1. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
- C. Advise Owner of pending insurance change-over requirements.
- D. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
- E. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, signed inspection certificates, operating certificates and similar releases.
- F. Submit record 'AS-BUILT' drawings, maintenance manuals, final project photographs, damage or settlement survey, property survey, and similar final record information.
- G. Deliver tools, spare parts, extra stock, and similar items.
- H. Make final change-over of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of change-over in security provisions.
- I. Complete start-up testing of systems, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
- J. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.
- K. Field Observation Procedures: On receipt of a request field observation, the Architect will either proceed with field visit or advise the Contractor of unfulfilled requirements. The Architect will prepare the Certificate of Substantial Completion following field visit, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
 - 1. The Architect will repeat field observation when requested and assured that the Work has been substantially completed. Results of the completed field visit will form the basis of requirements for final acceptance.

1.3 FINAL ACCEPTANCE

- A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.
- B. Submit record 'AS-BUILT' drawings, maintenance manuals, final project photographs, damage or settlement survey, property survey, and similar final record information.
- C. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
- D. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
- E. Submit a certified copy of the Architect's final 'punch' list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance and the list has been endorsed and dated by the Architect.
- F. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion, or when the Owner took possession of and responsibility for corresponding elements of the Work.
- G. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- H. Re-inspection Procedure: At the Contractor's expense, per paragraph 9.8.2 in the Supplementary Conditions, the Architect will re-inspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Architect.
- I. Upon completion of re-inspection, the Architect will prepare a certificate of final acceptance, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.

1.4 RECORD DOCUMENT SUBMITTALS

- A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Architect's reference during normal working hours.
- B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
- C. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
- D. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.
- E. Note related Change Order numbers where applicable.
- F. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.
- G. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Product Data.

- H. Upon completion of the Work, submit record Specifications to the Architect for the Owner's records.
- I. Record Product Data: Maintain one copy of each Product Data submittal. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation. Note related Change Orders and mark-up of record drawings and Specifications.
- J. Upon completion of mark-up, submit complete set of record Product Data to the Architect for the Owner's records.
- K. Record Sample Submitted: Immediately prior to the date or dates of Substantial Completion, the Contractor will meet at the site with the Architect and the Owner's personnel to determine which of the submitted Samples that have been maintained during progress of the Work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's Sample storage area.
- L. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Architect for the Owner's records.
- M. Maintenance Manuals: Organize operating and maintenance data into suitable sets of manageable or larger size. Bind properly indexed data in individual heavy-duty 2-inch, 3-ring vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:
 - 1. Emergency instructions.
 - 2. Spare parts list.
 - 3. Copies of warranties.
 - 4. Wiring diagrams.
 - 5. Recommended "turn around" cycles.
 - 6. Inspection procedures.
 - 7. Shop Drawings and Product Data.
 - 8. Fixture lamping schedule.
 - 9. Names and telephone numbers of product manufacturers and suppliers or installers.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 CLOSEOUT PROCEDURES

- A. Operating and Maintenance Instructions: Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items:
 - 1. Maintenance manuals.
 - 2. Record documents.
 - 3. Spare parts and materials.
 - 4. Tools.
 - 5. Lubricants.
 - 6. Fuels.
 - 7. Identification systems.
 - 8. Control sequences.
 - 9. Hazards.
 - 10. Cleaning.
 - 11. Warranties and bonds.
 - 12. Maintenance agreements and similar continuing commitments.

- B. As part of instruction for operating equipment, demonstrate the following procedures:
 - 1. Start-up.
 - 2. Shutdown.
 - 3. Emergency operations.
 - 4. Noise and vibration adjustments.
 - 5. Safety procedures.
 - 6. Economy and efficiency adjustments.
 - 7. Effective energy utilization.
- C. In the case of systems requiring summer/winter change over, instruct Owners personnel in change over procedures, and assist Owner on site in the first seasonal change over after final completion.

3.2 FINAL CLEANING

- A. General: General cleaning during construction is required by the General Conditions and included in Section "Temporary Facilities".
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
- C. Complete the following cleaning operations after Substantial Completion Inspection but before Final Inspection.
 - 1. Remove labels that are not permanent labels, DO NOT REMOVE DOOR OR FRAME LABELS
 - 2. Clean transparent materials, including mirrors and glass in doors and windows.
 - a. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
 - 3. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances.
 - a. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
 - 4. Wipe surfaces of mechanical and electrical equipment.
 - a. Remove excess lubrication and other substances.
 - b. Clean plumbing fixtures to a sanitary condition.
 - c. Clean light fixtures and lamps.
- D. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances.
 - a. Sweep paved areas broom clean; remove stains, spills and other foreign deposits.
 - b. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.
- E. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.
- F. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.
- G. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

END OF SECTION

SECTION 01 74 00 - WARRANTIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.
- B. Refer to the General Conditions for terms of the Contractor's special warranty of workmanship and materials.
- C. General closeout requirements are included in Section "Project Closeout."
- D. Specific requirements for warranties for the Work and products and installations that are specified to be warranted are included in the individual Sections of Divisions-2 through -28.
- E. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.
- F. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.3 DEFINITIONS

- A. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.4 WARRANTY REQUIREMENTS

- A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
- B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefitted from use of the Work through a portion of its anticipated useful service life.
- D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

- E. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties in conflict with requirements of the Contract Documents.
- F. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.5 SUBMITTALS

- A. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.
- B. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Architect for approval prior to final execution.

1.6 Refer to individual Sections of Divisions-2 through -35 for specific content requirements, and particular requirements for submittal of special warranties.

- A. Form of Submittal: At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- B. Bind warranties and bonds in heavy-duty, commercial quality, 3-ring binder, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper. Identify binder as to contents with name of the product, and the name, address and telephone number of the installer.
- C. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 (NOT APPLICABLE).

PART 3 (NOT APPLICABLE).

END OF SECTION

SECTION 04 72 00 - CAST STONE MASONRY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Architectural cast stone.

1.2 RELATED REQUIREMENTS

- A. Section 07 92 00 - Joint Sealants: Sealing joints indicated to be left open for sealant.

1.3 REFERENCE STANDARDS

- A. ACI 318 - Building Code Requirements for Structural Concrete; 2019, with Errata (2021).
- B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.
- C. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 2019.
- D. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement; 2025.
- E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2024.
- F. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2018.
- G. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.
- H. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2025a.
- I. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019, with Editorial Revision (2022).
- J. ASTM C642 - Standard Test Method for Density, Absorption, and Voids in Hardened Concrete; 2021.
- K. ASTM C1364 - Standard Specification for Architectural Cast Stone; 2019.

1.4 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Test results of cast stone components made previously by the manufacturer.
- C. Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.
- D. Mortar Color Selection Samples.
- E. Verification Samples: Pieces of actual cast stone components not less than 6 inches square, illustrating range of color and texture to be anticipated in components furnished for the project.
- F. Source Quality Control Test Reports.
- G. Manufacturer's Qualification Data: Documentation showing compliance with specified requirements.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Manufacturer's production facility currently holds a Plant Certification from the Cast Stone Institute or the Architectural Precast Association.
 - 2. Adequate plant capacity to furnish quality, sizes, and quantity of cast stone required without delaying progress of the work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.
- B. Number each piece individually to match shop drawings and schedule.
- C. Store cast stone components and installation materials in accordance with manufacturer's instructions.
- D. Store cast stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt.
- E. Protect cast stone components during handling and installation to prevent chipping, cracking, or other damage.
- F. Store mortar materials where contamination can be avoided.
- G. Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Architectural Cast Stone:
 - 1. Any current producer member of the Architectural Precast Association.
 - 2. Any current producer member of the Cast Stone Institute.
 - 3. Cultured Stone by Westlake.

2.2 ARCHITECTURAL CAST STONE

- A. Cast Stone: Architectural concrete product manufactured to simulate appearance of natural granite, complying with ASTM C1364.
 - 1. Compressive Strength: As specified in ASTM C1364; calculate strength of pieces to be field cut at 80 percent of uncut piece.
 - 2. Freeze-Thaw Resistance: Demonstrated by laboratory testing in accordance with ASTM C1364.
 - 3. Surface Texture: Fine grained texture, with no bugholes, air voids, or other surface blemishes visible from distance of 20 feet.
 - 4. Color: Selected by Architect from manufacturer's full range.
 - 5. Remove cement film from exposed surfaces before packaging for shipment.
- B. Shapes: Provide shapes indicated on drawings.
 - 1. Variation from Any Dimension, Including Bow, Camber, and Twist: Maximum of plus/minus 1/8 inch or length divided by 360, whichever is greater, but not more than 1/4 inch.
 - 2. Unless otherwise indicated on drawings, provide:
 - a. Wash or slope of 1:12 on exterior horizontal surfaces.
 - b. Drips on projecting components, wherever possible.
 - c. Raised fillets at back of sills and at ends to be built in.
- C. Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI 318.

2.3 MATERIALS

- A. Portland Cement: ASTM C150/C150M.
 - 1. For Mortar: Type I or II, except Type III may be used in cold weather.
- B. Coarse Aggregate: ASTM C33/C33M, except for gradation; granite, quartz, or limestone.
- C. Fine Aggregate: ASTM C33/C33M, except for gradation; natural or manufactured sands.
- D. Admixtures: ASTM C494/C494M.
- E. Water: Potable.
- F. Reinforcing Bars: ASTM A615/A615M, Grade 40 (40,000 psi), deformed bars, galvanized.
 - 1. Galvanized in accordance with ASTM A767/A767M, Class I.
- G. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, galvanized or ASTM A884/A884M, epoxy coated.
- H. Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions.
- I. Mortar: Portland cement-lime, as specified in Section 04 05 11 ; do not use masonry cement.
- J. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

2.4 SOURCE QUALITY CONTROL

- A. Test compressive strength and absorption of specimens selected at random from plant production.
 - 1. Test in accordance with ASTM C642.
 - 2. Select specimens at rate of 3 per 500 cubic feet, with a minimum of 3 per production week.
 - 3. Submit reports of tests by independent testing agency, showing compliance with requirements.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine construction to receive cast stone components. Notify Architect if construction is not acceptable.
- B. Do not begin installation until unacceptable conditions have been corrected.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Mechanically anchor cast stone units indicated; set remainder in mortar.
- C. Setting:
 - 1. Drench cast stone components with clear, running water immediately before installation.
 - 2. Set units in a full bed of mortar unless otherwise indicated.
 - 3. Fill vertical joints with mortar.
 - 4. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

3.3 TOLERANCES

- A. Joints: Make all joints 3/8 inch, except as otherwise detailed.
 - 1. Rake mortar joints 3/4 inch for pointing.
 - 2. Remove excess mortar from face of stone before pointing joints.

3. Point joints with mortar in layers 3/8 inch thick and tool to a slight concave profile.
4. Leave the following joints open for sealant:
 - a. Head joints in top courses, including copings, parapets, cornices, sills, and steps.
 - b. Joints in projecting units.
 - c. Joints between rigidly anchored units, including soffits, panels, and column covers.
 - d. Joints below lugged sills and stair treads.
 - e. Joints below ledge and relieving angles.
 - f. Joints labeled "expansion joint".

B. Installation Tolerances:

1. Variation from Plumb: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet or more.
2. Variation from Level: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet, or 3/8 inch maximum.
3. Variation in Joint Width: Not more than 1/8 inch in 36 inches or 1/4 of nominal joint width, whichever is less.
4. Variation in Plane Between Adjacent Surfaces (Lipping): Not more than 1/16 inch difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

3.4 CLEANING

- A. Keep cast stone components clean as work progresses.

3.5 PROTECTION

- A. Protect completed work from damage.
- B. Clean, repair, or restore damaged or mortar-splashed work to condition of new work.

END OF SECTION

SECTION 04 73 00 - MANUFACTURED STONE MASONRY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Adhered manufactured stone masonry veneer (AMSMV).
- B. Installation materials.

1.2 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Wood stud backup for AMSMV; plywood and OSB sheathing.
- B. Section 07 25 00 - Weather Barriers: Water-resistive barrier over sheathing.
- C. Section 07 62 00 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.
- D. Section 07 92 00 - Joint Sealants: Sealing control and expansion joints.

1.3 REFERENCE STANDARDS

- A. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry; 2019a.
- B. ASTM C1780 - Standard Practice for Installation Methods for Cement-Cased Adhered Masonry Veneer; 2020.
- C. ICC-ES AC51 - Acceptance Criteria for Adhered Manufactured Stone Masonry Veneer; 2018, with Editorial Revision (2021).
- D. NCMA (AMSV) - Installation Guide and Detailing Options for Compliance with ASTM C1780 for Adhered Manufactured Stone Veneer; Current Edition, Including All Revisions.
- E. NCMA TEK 20-01 - Key Installation Checkpoints for Manufactured Stone Veneer; 2014.
- F. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

1.4 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for AMSMV units, mortar, and lath, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Verification Samples: For each finish product specified, two samples, minimum size 12 inches square, representing actual product, color, patterns and texture.
- D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 MOCK-UPS

- A. Construct mock-up panel 8 feet long by 6 feet high; include AMSMV, mortar, accessories, substrate, and representative wall openings.
- B. Locate where directed.
- C. Mock-up may remain as part of the work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Prevent mechanical damage and contamination by other materials.
- C. Protect products from precipitation combined with freezing temperatures. Do not install products with visible frozen moisture.

1.7 FIELD CONDITIONS

- A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

1.8 WARRANTY

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

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Adhered Manufactured Stone Masonry Veneer (AMSMV):
 - 1. Any current producer member of the Masonry Veneer Manufacturers Association.

2.2 MORTAR APPLICATIONS

- A. Use only factory premixed packaged dry materials for mortar, with addition of water only at project site.
 - 1. Exception: If a specified mix design is not available in a premixed dry package, provide equivalent mix design using standard non-premixed materials.
- B. Mortar Color: Natural gray unless otherwise indicated.
- C. Scratch Coat Mortars: Scratch coat mortars for application directly to metal lath.
 - 1. Prepackaged/Preblended: ASTM C1714/C1714M, Type N.
- D. Pointing Mortars: Pointing or grouting mortars used to fill the joints between individual AMSMV units once the setting bed mortar has sufficiently cured.
 - 1. Prepackaged/Preblended: ASTM C1714/C1714M, Type N.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that backup wall system construction complies with AMSMV manufacturer's instructions, NCMA (AMSV), NCMA TEK 20-01, ASTM C1780 and ICC-ES AC51.
- B. Verify that related items provided under other sections are properly sized and located.

3.2 PREPARATION

- A. Dampen masonry surfaces to reduce excessive suction.

3.3 INSTALLATION - WATER-RESISTIVE BARRIER

- A. Where required by AMSMV manufacturer's instructions, NCMA (AMSV), NCMA TEK 20-01, ASTM C1780 or ICC-ES AC51, install 2 layers of water-resistive barrier in accordance with water-resistive barrier manufacturer's instructions. Integrate water-resistive barrier with all flashing accessories, adjacent water-resistive barriers, doors, windows, penetrations, and cladding transitions.

- B. In two layer applications, start with two horizontal layers at bottom of exterior wall or structure.

3.4 INSTALLATION - MASONRY FLASHINGS

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

3.5 CONTROL AND EXPANSION JOINTS

- A. Form joints as detailed on drawings.

3.6 TOLERANCES

- A. Maximum Variation from Unit to Adjacent Unit: 1/16 inch.
- B. Maximum Variation from Plane of Wall: 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.
- C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- D. Maximum Variation from Level Coursing: 1/8 inch in 3 feet and 1/4 inch in 10 feet; 1/2 inch in 30 feet.

3.7 CUTTING AND FITTING

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

3.8 CLEANING

- A. Remove excess mortar and mortar smears as work progresses.
- B. Replace defective mortar. Match adjacent work.
- C. Clean AMSMV in accordance with manufacturer's installation instructions.
- D. Clean soiled surfaces with cleaning solution.
- E. Use non-metallic tools in cleaning operations.

3.9 PROTECTION

- A. Protect finished work from rain during and for 48 hours following installation.
- B. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 GENERAL

1.1 Section Includes

- A. Structural dimension lumber framing.
- B. Nonstructural dimension lumber framing.
- C. Rough opening framing for doors, windows, and roof openings.
- D. Sheathing.
- E. Subflooring.
- F. Underlayment.
- G. Roof-mounted curbs.
- H. Roofing nailers.
- I. Roofing cant strips.
- J. Preservative treated wood materials.
- K. Fire retardant treated wood materials.
- L. Communications and electrical room mounting boards.
- M. Concealed wood blocking, nailers, and supports.

1.2 Related Requirements

- A. Section 07 62 00 - Sheet Metal Flashing and Trim: Sill flashings.

1.3 Reference Standards

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.
- B. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2017).
- C. ASTM D2898 - Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010 (Reapproved 2017).
- D. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing; 2019a.
- E. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies; 2018.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- G. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.
- H. AWC (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; 2024, with Errata.
- I. AWPA U1 - Use Category System: User Specification for Treated Wood; 2022.

- J. ICC-ES AC310 - Acceptance Criteria for Water-resistive Membranes Factory-bonded to Wood-based Structural Sheathing, Used as Water-Resistive Barriers; 2008, with Editorial Revision (2015).
 - K. PS 1 - Structural Plywood; 2023.
 - L. PS 2 - Performance Standard for Wood Structural Panels; 2018.
 - M. PS 20 - American Softwood Lumber Standard; 2021.
- 1.4 Submittals
- A. See Section 01 31 50 - Submittals for submittal procedures.
 - B. Product Data: Provide technical data on wood preservative materials and application instructions.
 - C. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.
- 1.5 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, and installation.
- 1.6 Warranty
- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

- 2.1 General Requirements
- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
 - 2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
- 2.2 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):
 - 1. Species: Allowed under referenced grading rules.
 - 2. Grade: No. 2.
 - D. Joist, Rafter, and Small Beam Framing (2 by 6 through 4 by 16):
 - 1. Species: Allowed under grading rules.
 - 2. Grade: No. 1 and Better.
 - E. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 2 or Standard Grade.
 - 2. Boards: Standard or No. 3.
- 2.3 Construction Panels
- A. Subfloor/Underlayment Combination: Rated single floor.

1. Plywood: PS 1.
 1. Oriented Strand Board: PS 2.
 2. Bond Classification: Exposure 1.
 3. Span Rating: 48.
 4. Edges: Tongue and groove.
- B. Subflooring: Oriented strand board wood structural panel; PS 2, rated Single Floor.
1. Bond Classification: Exterior.
 2. Performance Category: 19/32 PERF CAT.
 3. Span Rating: 24.
 4. Edges: Tongue and groove.
 5. Exposure Time: Sheathing will not delaminate or require sanding due to moisture absorption from exposure to weather for up to 200 days.
 6. Warranty: Manufacturer's standard lifetime limited warranty against manufacturing defects and that panels will not delaminate or require sanding due to moisture absorption damage from exposure to weather for up to the stated period.
- C. Roof Sheathing: PS 2 type, rated Structural I Sheathing.
1. Bond Classification: Exposure 1.
 2. Span Rating: 20.
 3. Performance Category: 3/4 PERF CAT.
- D. Wall Sheathing: PS 2 type.
1. Bond Classification: Exterior.
 2. Grade: Structural I Sheathing.
 3. Span Rating: 24.
 4. Performance Category: 5/16 PERF CAT.
 5. Edge Profile: Square edge.
- E. Wall Sheathing: Oriented strand board, structural wood panel with factory-laminated insulation board, water-resistive barrier.
1. Sheathing Panel: PS 2, Exposure 1.
 - a. Size: 4 feet wide by 8 feet long.
 - b. Grade: Sheathing.
 - c. Performance Category: 7/16 PERF CAT.
 - d. Span Rating: 24/16.
 - e. Edge Profile: Square edge.
 2. Integral Water-Resistive Barrier: Sheet material qualifying as a Grade D water-resistive barrier; complying with ICC-ES AC310.
 3. Water Vapor Permeance of Water-Resistive Barrier: 12 to 16 perms, minimum, when tested in accordance with ASTM E96/E96M Procedure B.
 4. Maximum Allowable Air Leakage of Assembly: Comply with ASTM E2357.
 - a. Infiltration: 0.0072 cfm/sq ft, maximum, at a pressure differential of 1.57 psf.
 - b. Exfiltration: 0.0023 cfm/sq ft, maximum, at a pressure differential of 1.57 psf.
 5. Provide fastening guide on top panel surface with separate markings indicating fastener spacing for 16 inches and 24 inches on center, respectively.
 6. Seam Tape: Manufacturer's standard pressure-sensitive, self-adhering, cold-applied, seam tape.
 7. Warranty: Manufacturer's standard 30 year limited system warranty.
 - a. Performance: Panel and tape resistance to water penetration; tape adhesion.
 - b. Material: Free from manufacturing defects and panel delamination.
 8. Manufacturers:
 - a. Huber Engineered Woods, LLC; ZIP System Roof/Wall Sheathing and ZIP System Seam Tape: www.huberwood.com/#sle.
- F. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
- G. Other Applications:

1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
3. Other Locations: PS 1, C-D Plugged or better.

2.4 Accessories

- A. Metal and Finish of Fasteners:
 1. Fire-Retardant-Treated Wood:
 - a. Comply with manufacturer's recommendations.
 1. Untreated Wood: Unfinished steel.
- B. Fasteners and Anchors:
 1. Metal and Finish: Stainless steel 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.
 3. Anchors: Expansion shield and lag bolt type for anchorage to solid masonry or concrete.
- C. Die-Stamped Connectors: Hot dipped galvanized steel, sized to suit framing conditions.
 1. For contact with preservative treated wood in exposed locations, provide minimum G185 galvanizing complying with ASTM A653/A653M.
- D. Joist Hangers: Hot dipped galvanized steel, sized to suit framing conditions.
 1. For contact with preservative treated wood in exposed locations, provide minimum G185 galvanizing complying with ASTM A653/A653M.
- E. Sill Gasket on Top of Foundation Wall: 3/8 inch thick, closed-cell plastic foam.
 1. Width: 3-1/2 inches.
 1. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 30 days of weather exposure.
- F. Sill Flashing: See Section 07 62 00.
- G. Subfloor Adhesives: Gap-filling construction adhesive for bonding wood structural panels to wood-based floor system framing; complying with ASTM D3498.
- H. Seam and Perimeter Tape: Polyethylene-faced material with acrylic adhesive.
 1. Thickness: 12 mils, 0.012 inch.
 1. Products:
 - a. Huber Engineered Woods, LLC; ZIP System Flashing Tape: www.huberwood.com/#sle.

2.5 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.
 2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.
- B. Fire Retardant Treatment:
 1. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
 - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - b. Do not use treated wood in direct contact with the ground.

2. Interior Type A: AWP A U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
 - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - b. Treat rough carpentry items as indicated .
 - c. Do not use treated wood in applications exposed to weather or where the wood may become wet.
- C. Preservative Treatment:
 1. Preservative Pressure Treatment of Lumber Above Grade: AWP A U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
 - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - b. Treat lumber in contact with masonry or concrete.
 - c. Treat lumber less than 18 inches above grade.
 - d. Treat lumber in other locations as indicated.
 2. Preservative Pressure Treatment of Plywood Above Grade: AWP A U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative.
 - a. Kiln dry plywood after treatment to maximum moisture content of 15 percent.
 3. Preservative Pressure Treatment of Lumber in Contact with Soil: AWP A U1, Use Category UC4A, Commodity Specification A using waterborne preservative.
 - a. Preservative for Field Application to Cut Surfaces: As recommended by manufacturer of factory treatment chemicals for brush-application in the field.
 - b. Restrictions: Do not use lumber or plywood treated with chromated copper arsenate (CCA) in exposed exterior applications subject to leaching.

PART 3 EXECUTION

3.1 Preparation

- A. Where wood framing bears on cementitious foundations, install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of 4 inches and seal.
- B. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.
- C. Coordinate installation of rough carpentry members specified in other sections.

3.2 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.

3.3 Framing Installation

- A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.
- B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.
- C. Install structural members full length without splices unless otherwise specifically detailed.

- D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AWC (WFCM) Wood Frame Construction Manual.
- E. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.
- F. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.4 Blocking, Nailers, and Supports

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to authorities having jurisdiction may be used in lieu of solid wood blocking.
- C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- D. 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.
- E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- F. Provide nonstructural framing and blocking to support the following:
 - 1. Cabinets and shelf supports.
 - 2. Wall brackets.
 - 3. Handrails.
 - 4. Grab bars.
 - 5. Towel and bath accessories.
 - 6. Wall-mounted door stops.
 - 7. Chalkboards and marker boards.
 - 8. Wall paneling and trim.
 - 9. Joints of rigid wall coverings that occur between studs.
 - 10. Other wall- or ceiling-mounted items indicated on drawings.

3.5 Roof-Related Carpentry

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
- B. Provide wood curb at each roof opening except where specifically indicated otherwise; form corners by alternating lapping side members.

3.6 Installation of Construction Panels

- A. Subflooring/Underlayment Combination: Glue and nail to framing; staples are not permitted.
- B. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
 - 1. Nail panels to framing; staples are not permitted.
- C. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.
- D. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches 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, installed horizontally at ceiling height.

3.7 Site-Applied Wood Treatment

- A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.
- B. Allow preservative to dry prior to erecting members.

3.8 Tolerances

- A. Framing Members: 1/4 inch from true position, maximum.
- B. Surface Flatness of Floor: 1/8 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.
- C. Variation from Plane, Other than Floors: 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

END OF SECTION

SECTION 06 20 00 - FINISH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Finish carpentry items.
- A. Hardware.
- A. Shop finishing.

1.2 RELATED REQUIREMENTS

- A. Section 09 91 23 - Interior Painting.

1.3 REFERENCE STANDARDS

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
- C. PS 1 - Structural Plywood; 2023.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.
- B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.5 SUBMITTALS

- A. See Section 01 31 50 - Submittals for submittal procedures.
- B. Product Data:
 - 1. Provide manufacturer's product data, storage and handling instructions for factory-fabricated units.
 - 2. Provide data on wood treatment.
 - 3. Provide instructions for attachment hardware and finish hardware.
- C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
 - 2. Include certification program label.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
 - 1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
- B. Quality Certification:
 - 1. Provide labels or certificates indicating that work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
 - 2. Provide designated labels on shop drawings as required by certification program.
 - 3. Provide designated labels on installed products as required by certification program.
 - 4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.7 MOCK-UPS

- A. Provide column wrap mock-up, full size, illustrating finish, construction, and _____.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-fabricated units to project site in original packages, containers or bundles bearing brand name and identification.
- B. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.
- C. Protect from moisture damage.
- D. Handle materials and products to prevent damage to edges, ends, or surfaces.

PART 2 PRODUCTS

2.1 FINISH CARPENTRY ITEMS

- A. Quality Standard: Custom 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. Exterior Woodwork Items:
 - 1. Window Casings and Moldings: Softwood; prepare for paint finish.
 - 2. Brackets, Finials, and Pediments: Prepare for paint finish.
- D. Interior Woodwork Items:
 - 1. Moldings, Bases, Casings, and Miscellaneous Trim: Clear white pine; prepare for paint finish.
 - 2. Door, Glazed Light, and Pocket Door Frames: White birch; prepare for paint finish.
 - 3. Window Sills: Clear fir; prepare for transparent finish.
 - 4. Stairs, Balustrades, and Handrails: Clear fir; prepare for stained finish.
 - 5. Loose Shelving: Birch plywood; prepare for paint finish.

2.2 SHEET MATERIALS

- A. Softwood Plywood, Not Exposed to View: Any face species, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.

2.3 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Lumber for Shimming and Blocking: Softwood lumber of indicated species.
- C. Wood Filler: Solvent base, tinted to match surface finish color.

2.4 HARDWARE

- A. Vanity Brackets: Fixed, ADA-Compliant, face-of-stud mounting.
 - 1. Material: Steel; formed compound shapes.
- B. Countertop Brackets: Fixed, Flat, top of knee wall mounting.
 - 1. Material: Steel plates.
 - 2. Finish: Manufacturer's standard, factory-applied, textured powder coat.
 - 3. Color: Black.
 - 4. Support Length: 15 inches.
 - 5. Plate Thickness and Width: 3/8 inch by 2-1/2 inches.

6. Products:
 - a. Centerline Brackets; Standard Bracket SB4H: www.countertopbracket.com/#sle.
 - C. Vanity Brackets: Fixed, cantilevered support leg, face-of-stud mounting.
 1. Materials: Steel L-shapes.
 2. Finish: Manufacturer's standard, factory-applied, textured powder coat.
 3. Color: Black.
 4. Angle Depth: 2 inches.
 5. Width: 28 inches.
 6. Support Length: 18 inches.
- 2.5 SITE-FINISHING MATERIALS
- 2.6 FABRICATION
- A. Shop assemble work for delivery to site, permitting passage through building openings.
 - B. Fit exposed sheet material edges with 3/8 inch matching hardwood edging. Use one piece for full length only.
 - C. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
- 2.7 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 - 1, Lacquer, Nitrocellulose.
 - b. Sheen: Flat.
 2. Opaque:
 - a. System - 1, Lacquer, Nitrocellulose.
 - b. Color: As selected by Architect.
 - c. Sheen: Flat.

PART 3 EXECUTION

- 3.1 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.
- 3.2 INSTALLATION
- A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
 - B. Install factory-fabricated units in accordance with manufacturer's printed installation instructions.
 - C. Set and secure materials and components in place, plumb and level.

- D. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

3.3 PREPARATION FOR SITE FINISHING

- A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

END OF SECTION

SECTION 07 11 13 - BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Bituminous dampproofing.
- B. Protection boards.
- C. Drainage panels.

1.2 REFERENCE STANDARDS

- A. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2011 (Reapproved 2016).
- B. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal; 1997 (Reapproved 2018).
- C. ASTM D1227/D1227M - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing; 2013, with Editorial Revision (2019).

1.3 SUBMITTALS

- A. See Section 01 31 50 - Submittals for submittal procedures.
- B. Product Data: Provide properties of primer, bitumen, and mastics.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience.

1.5 FIELD CONDITIONS

- A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application until dampproofing has cured.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Bituminous Dampproofing Manufacturers:
 - 1. BASF Corporation: www.basf.com.
 - 2. Euclid Chemical Company; an RPM company: www.euclidchemical.com.
 - 3. Henry Company: www.henry.com.
 - 4. Karnak Corporation: www.karnakcorp.com/#sle.
 - 5. W. R. Meadows, Inc: www.wrmeadows.com/#sle.

2.2 BITUMINOUS DAMPPROOFING

- A. Bituminous Dampproofing: Cold-applied water-based emulsion; asphalt with mineral colloid or chemical emulsifying agent; with or without fiber reinforcement; asbestos-free; suitable for application on vertical and horizontal surfaces.
 - 1. Asphalt-Base Emulsion for Metal Protective Coating: ASTM D1187/D1187M, Type I - Continuous water exposure within few days after drying or Type II - Continuous weather exposure after drying.

2. Emulsified Asphalt for Roofing Protective Coating: ASTM D1227/D1227M, Type II, Class 1 - Mineral colloid emulsifying agents with non-asbestos fibers.
3. VOC Content: Not more than permitted by local, State, and federal regulations.
4. Applied Thickness: 1/16 inch, minimum, wet film.

- B. Primers, Mastics, and Related Materials: Type as recommended by dampproofing manufacturer.

2.3 BITUMEN MATERIALS

- A. Cold Asphaltic Type:
1. Bitumen: Emulsified asphalt, ASTM D1227/D1227M, without fibrous reinforcement, Type III, Class 1 or 2.
 2. Asphalt Primer: ASTM D41/D41M, compatible with substrate.

2.4 ACCESSORIES

- A. Drainage Panel: 1/4-inch thick formed plastic, hollowed sandwich.
- B. Protection Board: 1/4-inch thick polystyrene foam sheet.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions are acceptable prior to starting this work.
- B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.
- C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

3.2 PREPARATION

- A. Protect adjacent surfaces not designated to receive dampproofing.
- B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.
- C. Do not apply dampproofing to surfaces unacceptable to manufacturer.
- D. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

3.3 APPLICATION

- A. Foundation Walls: Apply two coats of asphalt dampproofing.
- B. Apply bitumen with roller.
- C. Apply bitumen at a temperature limited by equiviscous temperature (EVT) plus or minus 25 degrees F; do not exceed finish blowing temperature for four hours.
- D. Apply from 2 inches below finish grade elevation down to top of footings.
- E. Seal items watertight with mastic, that project through dampproofing surface.
- F. Place drainage panel directly over dampproofing, butt joints, and position to ensure downward drainage.
- G. Scribe and cut boards around projections, penetrations, and interruptions.

END OF SECTION

SECTION 07 21 00 - THERMAL INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Board insulation and integral vapor retarder at perimeter foundation wall and exterior wall behind wall finish.
- B. Batt insulation and vapor retarder in exterior wall, ceiling, and roof construction.
- C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.2 RELATED REQUIREMENTS

- A. Section 07 53 00 - Elastomeric Membrane Roofing: Installation requirements for board insulation over low slope roof deck.

1.3 REFERENCE STANDARDS

- A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.
- B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- D. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024c.

1.4 SUBMITTALS

- A. See Section 01 31 50 - Submittals for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.1 FOAM BOARD INSULATION MATERIALS

- A. Extruded Polystyrene (XPS) Board Insulation: Comply with ASTM C578 with either natural skin or cut cell surfaces.
 - 1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.
 - 2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
 - 3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
 - 4. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88), minimum, per 1 inch thickness at 75 degrees F mean temperature.
 - 5. Board Edges: Square.
 - 6. Type and Water Absorption: Type XII, 0.3 percent by volume, maximum, by total immersion.
 - 7. Products:
 - a. DuPont de Nemours, Inc; Styrofoam Brand Square Edge: building.dupont.com/#sle.

- b. Kingspan Insulation LLC; GreenGuard XPS Type IV, 25 psi: www.kingspan.com/#sle.
- c. Owens Corning Corporation; FOAMULAR Type ____ Extruded Polystyrene (XPS) Insulation: www.ocbuildingspec.com/#sle.

2.2 MINERAL FIBER BLANKET INSULATION MATERIALS

- A. Glass Fiber Batt Insulation - Unfaced: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
 - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 - 3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
 - 4. Formaldehyde Content: Zero.
 - 5. Thermal Resistance: R-value - as indicated..
 - 6. Facing: Unfaced.
 - 7. Products:
 - a. CertainTeed Corporation: www.certainteed.com/#sle.
 - b. Johns Manville: www.jm.com/#sle.
 - c. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
 - d. Knauf Insulation.
- B. Glass Fiber Batt Insulation - Kraft Faced: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
 - 1. Type II(non-reflective faced), Class C(faced surface not rated for flame propagation), Category 1(membrane is a vapopr barrier).
 - 2. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
 - 3. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 - 4. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
 - 5. Formaldehyde Content: Zero.
 - 6. Thermal Resistance: R-valueas Indicated..
 - 7. Facing: Asphalt treated Kraft paper, one side.
 - 8. Products:
 - a. CertainTeed Corporation: www.certainteed.com/#sle.
 - b. Johns Manville: www.jm.com/#sle.
 - c. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
 - d. Knauf Insulation.
- C. Glass Fiber Batt Insulation - Foil Faced: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
 - 1. Type III(reflective faced), Class B(faced surface with a flame propagation resistance of 0.12 W/sq. cm), Category 1(membrane is a vapopr barrier).
 - 2. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
 - 3. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 - 4. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
 - 5. Formaldehyde Content: Zero.
 - 6. Thermal Resistance: R-value as indicated.
 - 7. Facing: Aluminum foil, one side.
 - 8. Products:
 - a. CertainTeed Corporation: www.certainteed.com/#sle.
 - b. Johns Manville: www.jm.com/#sle.
 - c. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
 - d. Knauf Insulation.
- D. Mineral Wool Blanket Thermal Insulation: Flexible or semi-rigid preformed insulation, complying with ASTM C665.
 - 1. Thermal Resistance: R-value of as indicated.
 - 2. Products:
 - a. Johns Manville; MinWool Sound Attenuation Fire Batts: www.jm.com/#sle.

- b. ROCKWOOL; AFB: www.rockwool.com/#sle.
- c. Thermafiber, Inc; SAFB: www.thermafiber.com/#sle.

2.3 ACCESSORIES

- A. Sheet Vapor Retarder: Polyethylene film for above grade application, 10 mil, 0.010 inch thick.
- B. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- C. Insulation Fasteners: Appropriate for purpose intended and recommended for use by manufacturer..
- D. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 BOARD INSTALLATION AT FOUNDATION PERIMETER

- A. Apply adhesive to back of boards:
 - 1. Three continuous beads per board length.
 - 2. Full bed 1/8 inch thick.
- B. Install boards horizontally on foundation perimeter.
 - 1. Butt edges and ends tightly to adjacent boards and to protrusions.
- C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.3 BOARD INSTALLATION AT EXTERIOR WALLS

- A. Apply adhesive to back of boards:
 - 1. Three continuous beads per board length.
 - 2. Full bed 1/8 inch thick.
- B. Install boards horizontally on walls.
 - 1. Place boards to maximize adhesive contact.
 - 2. Install in running bond pattern.
 - 3. Butt edges and ends tightly to adjacent boards and protrusions.
- C. Extend boards over expansion joints, unbonded to wall on one side of joint.
- D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- E. Tape insulation board joints.

3.4 BOARD INSTALLATION OVER LOW SLOPE ROOF DECK

- A. Board Installation Over Roof Deck, General:
 - 1. See applicable roofing specification section for specific board installation requirements.
 - 2. Fasten insulation to deck in accordance with roofing manufacturer's written instructions and applicable Factory Mutual requirements.
 - 3. Do not apply more insulation than can be covered with roofing on the same day.

3.5 BATT INSTALLATION

- A. Install insulation and vapor retarder in accordance with manufacturer's instructions.
- B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
- E. Install with factory-applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.
- F. Staple or nail facing flanges in place at maximum 6 inches on center.
- G. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.
- H. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
- I. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
- J. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- K. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces including but not limited to all door and window openings where required to prevent gaps in insulation using the following materials:
- L. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..

3.6 PROTECTION

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

END OF SECTION

SECTION 07 21 26 - BLOWN INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Attic: Blown insulation pneumatically placed into truss spaces.

1.2 REFERENCE STANDARDS

- A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- B. ASTM C764 - Standard Specification for Mineral Fiber Loose-Fill Thermal Insulation; 2025.
- C. ASTM C1015 - Standard Practice for Installation of Cellulosic and Mineral Fiber Loose-Fill Thermal Insulation; 2017 (Reapproved 2025).

1.3 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and limitations.
- C. Certificates: Certify that products of this section meet or exceed specified requirements.
- D. Manufacturer's Installation Instructions: Indicate procedure for preparation and installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Blown Insulation:
 - 1. CertainTeed Corporation: www.certainteed.com/#sle.
 - 2. GreenFiber: www.greenfiber.com/#sle.
 - 3. Johns Manville: www.jm.com/#sle.
 - 4. Knauf Insulation; Performance+ Jet Stream Ultra Blowing Wool: www.knaufinsulation.com/#sle.
 - 5. Nu-Wool: <https://nuwool.com/#sle>.
 - 6. Thermafiber, Inc: www.thermafiber.com/#sle.
 - 7. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
 - 8. _____.

2.2 MATERIALS

- A. Applications: Provide blown insulation in attic, exterior walls, and ceiling as indicated on drawings.
- B. Thermal Resistance [R-value]: Provided minimum values in accordance with applicable edition of ASHRAE Std 90.1 I-P for envelope requirements of building location and climate zone.
- C. Blown Insulation: ASTM C764, fiberglass type, nodulated for pour and bulk for pneumatic placement.
 - 1. Thermal Resistance (R-value: 11.0 sq ft hr deg F/BTU inch, minimum.

2.3 Accessories

- A. Roof Ventilation Baffles: Prefabricated ventilation channels for placement under roof sheathing with baffles to prevent wind-washing.
 - 1. Material: Polyvinyl chloride (PVC).

2. Roof Joist/Truss Spacing: 24 inch on center, nominal.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that substrate and adjacent materials are dry and ready to receive insulation.
- B. Verify that light fixtures have thermal cut-out device to restrict over-heating in soffit or ceiling spaces.
- C. Verify spaces are unobstructed to allow for proper placement of insulation.

3.2 INSTALLATION

- A. Install insulation and ventilation baffle in accordance with ASTM C1015 and manufacturer's instructions.
- B. Place insulation pneumatically to completely fill truss spaces.
- C. Place insulation against baffles, and do not impede natural attic ventilation to soffit.
- D. Completely fill intended spaces leaving no gaps or voids.

3.3 CLEANING

- A. Remove loose insulation residue.

END OF SECTION

SECTION 07 26 00 - VAPOR RETARDERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Vapor retarders.

1.2 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Vapor retarder under concrete slabs on grade.
- B. Section 07 21 00 - Thermal Insulation: Vapor retarder installed in conjunction with insulation products.

1.3 DEFINITIONS

- A. Vapor Retarder: Airtight barrier made of material that is relatively water vapor impermeable, to degree specified, with seams and joints sealed to adjacent surfaces.
- B. Vapor Retarder Class: A measure of a material or assembly's ability to limit the amount of moisture that passes through that material or assembly. Vapor retarder class is defined using Procedure A, Desiccant Method at 73 degrees F and 50 percent Relative Humidity (RH), in accordance with ASTM E96/E96M and ICC (IBC)-2018, as follows:
 - 1. Class I: 0.1 perm or less.
 - 2. Class II: Greater than 0.1 perm to 1.0 perm.
 - 3. Class III: Greater than 1.0 perm to 10 perms.

1.4 REFERENCE STANDARDS

- A. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.
- B. ICC (IBC)-2018 - International Building Code; 2018.

1.5 SUBMITTALS

- A. See Section 01 31 50 - Submittals for submittal procedures.
- B. Product Data: Provide data on material characteristics, performance criteria, limitations, and installation methods.
- C. Manufacturer's Installation Instructions: Indicate preparation, installation methods, storage and handling criteria, and special procedures, including perimeter, penetration and other conditions requiring special attention.
- D.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience, and approved by manufacturer.
- B. Preinstallation Meeting: Convene a preinstallation meeting two weeks before start of installation of reinforced vapor retarders. Require attendance of parties directly affecting work of this section, including Contractor, Architect, and installer. Review installation, protection, and coordination with other work.

1.7 FIELD CONDITIONS

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

1.8 COORDINATION

- A. Division 22 and Division 26 for penetrations through vapor retarder.
 - 1. Penetrations through the vapor retarder shall be coordinated and sequenced to allow proper flashing and sealing of all penetrations prior to placement of concrete.
 - 2. Penetrations through the vapor retarder shall be flashed and sealed prior to placement of concrete.
 - 3. Utility penetrations through the vapor retarder shall be a minimum of 12-inches apart.

PART 2 PRODUCTS

2.1 VAPOR RETARDERS

- A. Underslab Vapor Retarders: Refer to Vapor Mitigation documents

2.2 ACCESSORIES

- A. Sealants, Tapes, and Accessories for Sealing Vapor Retarder and Adjacent Substrates: As indicated, complying with vapor retarder manufacturer's installation instructions.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces and conditions comply with requirements of this section.

3.2 PREPARATION

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

3.3 INSTALLATION

- A. Install materials in accordance with manufacturer's installation instructions.
- B. Vapor Retarders: Install continuous airtight barrier over surfaces indicated, with sealed seams and sealed joints to adjacent surfaces.
- C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.

3.4 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Do not cover installed vapor retarders until required inspections have been completed.
- C. Take digital photographs of each portion of installation prior to covering up vapor retarders.

3.5 PROTECTION

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

END OF SECTION

SECTION 07 27 00 - AIR BARRIERS

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Sheathing with integral air barrier.

PART 3 EXECUTION

2.1 INSTALLATION

- A. Install materials in accordance with manufacturer's installation instructions.
- B. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.

2.2 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Notify manufacturer's designated representative to obtain required periodic observations of weather barrier assembly installation.
- C. Do not cover installed air barriers until required inspections have been completed and the written field service report has been received by the Contractor and Architect..

2.3 PROTECTION

- A. Protect installed air barrier.
- B. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 07 31 13 - ASPHALT SHINGLES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Asphalt shingle roofing.
- B. Flexible sheet membranes for eave protection, underlayment, and valley protection.
- C. Flashing.

1.2 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Roof sheathing.
- B. Section 07 62 00 - Sheet Metal Flashing and Trim: Edge and cap flashings.

1.3 REFERENCE STANDARDS

- A. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2025.
- B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2025.
- C. ASTM D3462/D3462M - Standard Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules; 2023.
- D. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2024).
- E. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.
- F. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings; 2025.
- G. NRCA (RM) - The NRCA Roofing Manual; 2025.
- H. UL (DIR) - Online Certifications Directory; Current Edition.

1.4 SUBMITTALS

- A. See Section 01 31 50 - Submittals for submittal procedures.
- B. Product Data: Provide data indicating material characteristics, performance criteria, limitations, and _____.
- C. Samples: Submit two samples of each shingle color indicating color range and finish texture/pattern ; for color selection.
- D. Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- E. Metal flashing products and materials specified in this Section are subject to the Build America, Buy America (BABA) requirements described in Division 01. Submit BABA Compliance Documentation demonstrating that products comply with HUD BABA requirements prior to procurement. Products not meeting BABA requirements shall not be incorporated into the Work.

1.5 QUALITY ASSURANCE

1.6 FIELD CONDITIONS

- A. Do not install shingles, eave protection membrane, underlayment, or _____ when surface, ambient air, wind chill, or _____ temperatures are below 45 degrees F.

1.7 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Correct defective work within a 1 -year period after Date of Substantial Completion.
- C. Provide 30 -year manufacturer's limited warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Asphalt Shingles:
1. CertainTeed Corporation; Landmark PRO: www.certainteed.com.
 2. GAF; Timberline HDZ Shingles: www.gaf.com/#sle.
 3. Malarkey Roofing; Vista: www.malarkeyroofing.com/#sle.
 4. Owens Corning Corp: www.owenscorning.com/#sle.
 5. Iko Industries: www.iko.com.
 6. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 ASPHALT SHINGLES

- A. Asphalt Shingles: Asphalt-coated glass felt, mineral granule surfaced, complying with ASTM D3462/D3462M.
1. Fire Resistance: Class A, complying with ASTM E108.
 2. Algae resistant.
 3. Style: Square.
 4. Color: As selected by Architect.

2.3 SHEET MATERIALS

- A. Underlayment: Self-adhering, rubber-modified asphalt sheet complying with ASTM D1970/D1970M; with strippable release film and woven polypropylene sheet top surface.
1. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
 2. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
 3. Water Vapor Permeance: 0.067 perm, when tested in accordance with ASTM E96/E96M, Procedure A (desiccant method).
 4. Performance: Meet or exceed requirements for ASTM D226/D226M, Type II asphalt-saturated organic felt.
 5. Functional Temperature Range: From minus 70 degrees F to 212 degrees F.
 6. Products:
 - a. GCP Applied Technologies Inc.; Grace Ice & Water Shield: www.gcpat.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Underlayment: Asphalt-saturated organic roofing felt, unperforated, complying with ASTM D226/D226M, Type II, No. 30.

2.4 ACCESSORIES

- A. Roofing Nails: Standard round wire shingle type, galvanized steel or aluminum roofing nails, minimum 3/8-inch head diameter, 12-gauge, 0.109-inch nail shank diameter, 1-1/2 inches long and complying with ASTM F1667.

- B. Asphalt Roof Cement: ASTM D4586/D4586M, asbestos-free.
- C. Plastic Ridge Vents: Extruded plastic with vent openings do not permit direct water or weather entry; flanged to receive shingles.

2.5 METAL FLASHINGS

- A. Metal Flashings: Provide sheet metal eave edge, gable edge, ridge, ridge vents, open valley flashing, chimney flashing, dormer flashing, step, kickout, and other flashing indicated.
 - 1. Form flashings to protect roofing materials from physical damage and shed water.
 - 2. Form sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance.
 - 3. Hem exposed edges of flashings minimum 1/4 inch on underside.
 - 4. Kickout Flashing
 - a. Product: J'd Out Kickout flashing or equal.
 - b. Color: As selected from manufacturer's full range.
- B. Aluminum Sheet Metal: Prefinished aluminum, 26-gauge, 0.017-inch minimum thickness; PVC coating, color as selected from full range.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions prior to starting this work.
- B. Verify roof deck is of sufficient thickness to accept fasteners.
- C. Verify roof penetrations and plumbing stacks are in place and flashed to deck surface.
- D. Verify roof openings are correctly framed.
- E. Verify deck surfaces are dry, free of ridges, warps, or voids.

3.2 PREPARATION

- A. Seal roof deck joints wider than 1/16 inch as recommended by shingle manufacturer.
- B. At areas where eave protection membrane is to be adhered to substrate, fill knot holes and surface cracks with latex filler.
- C. Broom clean deck surfaces before installing underlayment or eave protection.
- D. Install eave edge and gable edge flashings tight with fascia boards, weather lap joints 2 inches and seal with roof cement, and secure flange with nails spaced 6 inches on center.

3.3 INSTALLATION

3.4 CLEANING

- A. Clean exposed work upon completion of installation; remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to finish.

3.5 INSTALLATION - EAVE PROTECTION MEMBRANE

- A. Install eave protection membrane from eave edge at least 2 feet up-slope beyond interior face of exterior wall.

- B. Starting from lower edge of starter strip, lay additional 36-inch wide strips in lap cement to produce a 2-ply membrane. Weather lap plies minimum 19 inches and nail in place. Lap ends minimum 6 inches, and stagger end joints of each consecutive ply.

3.6 INSTALLATION - UNDERLAYMENT

- A. Underlayment at Roof Slopes up to 4:12: Install two layers of underlayment over area not protected by eave protection, with ends and edges weather lapped minimum 6 inches; stagger end laps of each consecutive layer, and nail in place.
- B. Underlayment at Roof Slopes Greater than 4:12: Install underlayment perpendicular to slope of roof, with ends and edges weather lapped minimum 4 inches; stagger end laps of each consecutive layer, nail in place, and weather lap minimum 4 inches over eave protection.
- C. Weather lap and seal watertight with roof cement any items projecting through or mounted on roof.

3.7 INSTALLATION - METAL FLASHING AND ACCESSORIES

- A. Install flashings in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.
- B. Weather lap metal flashing joints at least 2 inches and seal joints weathertight.
- C. Secure metal flashing in place with nails at 6 inches on center, and conceal fasteners.
- D. Items Projecting Through or Mounted on Roofing: Flash and seal weathertight with roof cement.

3.8 PROTECTION

- A. Do not permit traffic over finished roof surface; protect roofing until completion of project.
- B. Touch-up, repair, or replace damaged asphalt shingles or accessories before Date of Substantial Completion.

END OF SECTION

SECTION 07 46 17 - ALUMINUM SOFFIT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Aluminum soffit

1.2 SUBMITTALS

- A. See Section 01 31 50 - Submittals for submittal procedures.
- B. Products and materials specified in this Section are subject to the Build America, Buy America (BABA) requirements described in Division 01. Submit BABA Compliance Documentation demonstrating that products comply with HUD BABA requirements prior to procurement. Products not meeting BABA requirements shall not be incorporated into the Work.
- C. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Dimensions, physical properties, and typical details.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation instructions and recommendations.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Store products off the ground, within manufacturer's temperature and environmental limits, away from moisture, protected from traffic and construction activities, and minimize on-site storage prior to installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Aluminum Soffit Manufacturers:
 - 1. Quality Edge; TruVent Hidden Vent Soffit: www.qualityedge.com.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 ALUMINUM SOFFIT

- A. Aluminum Soffit:
 - 1. Material: Precoated aluminum sheet, 0.019 inch, minimum base metal thickness.
 - 2. Profile: TruVent Hidden Vent Soffit.
 - 3. Dimensions: 12 inch wide by 12 feet long.
 - 4. Ventilation: Provide manufacturer's standard of net free area.
 - 5. Color: White
 - 6. Soffit Accessories: Provide coordinating accessories made of same material as required for complete and proper installation.

PART 3 EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Prepare surfaces as recommended by manufacturer.
- B. Protect surrounding areas and adjacent surfaces during execution of this work.

3.2 INSTALLATION

- A. Install aluminum soffit and trim in accordance with manufacturer's written instructions.
- B. Exterior Soffit Vents: Install according to manufacturer's written instructions; provide vent area specified.

3.3 CLEANING

- A. See Section 01 70 00 - Execution Requirements for additional requirements.
- B. Remove grease and oil films, excess joint sealer, handling marks, and other installation debris from aluminum siding, leaving siding clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to material finishes.
- C. Remove excess materials and debris from project site.

3.4 PROTECTION

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

END OF SECTION

SECTION 07 46 46 - FIBER-CEMENT SIDING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fiber-cement siding.

1.2 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Siding substrate.
- B. Section 06 10 00 - Rough Carpentry: Water-resistive barrier under siding.
- C. Section 07 92 00 - Joint Sealants: Sealing joints between siding and adjacent construction and fixtures.
- D. Section 09 91 13 - Exterior Painting: Field painting.

1.3 REFERENCE STANDARDS

- A. ASTM C1186 - Standard Specification for Flat Fiber-Cement Sheets; 2022.

1.4 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
 - 1. Manufacturer's requirements for related materials to be installed by others.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods, including nail patterns.
- C. Test Report: Applicable model code authority evaluation report (e.g. ICC-ES).
- D. Installer's qualification statement.
- E. Maintenance Instructions: Periodic inspection recommendations and maintenance procedures.
- F. Warranty: Submit copy of manufacturer's warranty, made out in Owner's name, showing that it has been registered with manufacturer.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of type specified in this section with not less than three years of experience.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for fabrication and installation.
 - 1. Build mockup of typical wall area as shown on Drawings.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store materials in manufacturer's unopened packaging, with labels intact, until ready for installation.
- B. Store materials under dry and waterproof cover, well ventilated, and elevated above grade on a flat surface.

1.7 FIELD CONDITIONS

- A. Do not install panels when air temperature or relative humidity are outside manufacturer's limits.

1.8 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide manufacturer warranty for years as indicated under Fiber-Cement Siding article sub-headings for "Warranty". Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.1 FIBER-CEMENT SIDING

- A. Lap Siding: Individual horizontal boards made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
 - 1. Style: Standard lap style.
 - 2. Texture: Smooth.
 - 3. Length: 12 feet, nominal.
 - 4. Width (Height): 5-1/4 inches.
 - 5. Thickness: 5/16 inch, nominal.
 - 6. Finish: Factory applied primer.
 - 7. Warranty: 50 year limited; transferable.
 - 8. Products:
 - a. Allura, a division of Plycem USA, Inc; _____: www.allurausa.com/#sle.
 - b. James Hardie Building Products, Inc; _____: www.jameshardie.com/#sle.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 ACCESSORIES

- A. Trim: Same material and texture as siding.
- B. Fasteners: Galvanized or corrosion resistant; length as required to penetrate, 1-1/4 inches, minimum.
- C. Sealant: Elastomeric, polyurethane or silyl-terminated polyether/polyurethane, and capable of being painted.
- D. Finish Paint: Latex house paint acceptable to siding manufacturer; primer recommended by paint manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrate, clean and repair as required to eliminate conditions that would be detrimental to proper installation.
- B. Verify that water-resistant barrier has been installed over substrate completely and correctly; see Section 05 40 00.
- C. Do not begin until unacceptable conditions have been corrected.
- D. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Protect surrounding areas and adjacent surfaces during execution of this work.
- B. Install Sheet Metal Flashing:
 - 1. Above door and window trim and casings.
 - 2. Above horizontal trim in field of siding.

3.3 INSTALLATION

- A. Install siding in accordance with manufacturer's instructions and recommendations.
 - 1. Read warranty and comply with terms necessary to maintain warranty coverage.
 - 2. Install in accordance with conditions stated in model code evaluation report applicable to location of project.
 - 3. Use trim details as indicated on drawings.
 - 4. Touch up field cut edges before installing.
 - 5. Pre-drill nail holes if necessary to prevent breakage.
- B. Allow space for thermal movement between both ends of siding panels that butt against trim; seal joint between panel and trim with specified sealant.
- C. Joints in Horizontal Siding: Avoid joints in lap siding except at corners; where joints are inevitable stagger joints between successive courses.
- D. Do not install siding less than 6 inches from ground surface, or closer than 1 inch to roofs, patios, porches, and other surfaces where water may collect.
- E. After installation, seal joints except lap joints of lap siding; seal around penetrations, and paint exposed cut edges.
- F. Finish Painting: See Section 09 91 13.

3.4 PROTECTION

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

END OF SECTION

SECTION 07 53 00 - ELASTOMERIC MEMBRANE ROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Elastomeric roofing membrane application.
- B. Insulation, flat, tapered, and flat or tapered.
- C. Vapor retarder.
- D. Cover boards.
- E. Roofing cant strips, stack boots, roofing expansion joints, and walkway pads.

1.2 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Wood cant strips.

1.3 REFERENCE STANDARDS

- A. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2024.
- B. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2025.
- C. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 2015 (Reapproved 2021).
- D. FM (AG) - FM Approval Guide; Current Edition.
- E. FM DS 1-28 - Wind Design; 2015, with Editorial Revision (2025).
- F. UL (FRD) - Fire Resistance Directory; Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers; review preparation and installation procedures and coordination and scheduling necessary for related work.

1.5 SUBMITTALS

- A. See Section 01 31 50 - Submittals for submittal procedures.
- B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, surfacing, and fasteners.
- C. Shop Drawings: Indicate joint or termination detail conditions and conditions of interface with other materials.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
- F. Manufacturer's qualification statement.
- G. Installer's qualification statement.

- H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
- B. Source Limitations: Obtain components for membrane roofing system from or approved by roofing membrane manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact.
- B. Store materials in weather protected environment, clear of ground and moisture.
- C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.
- D. Protect foam insulation from direct exposure to sunlight.

1.8 FIELD CONDITIONS

- A. Do not apply roofing membrane during unsuitable weather.
- B. Do not apply roofing membrane when ambient temperature is below 40 degrees F.
- C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- E. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.
- F. Protect the interior of the building against water damage at all times while the roofing repair work is in progress.
- G. Protection: Schedule and execute all work to prevent damage to adjacent surfaces not to receive roof coating materials. Provide full coverage of adjacent metal surfaces. Repair damage caused to existing substrates. Clean stains from masonry and other adjacent surfaces upon completion of the work. Damage repair and cleaning performed at Contractor's expense. Provide necessary protection and avoid traffic on completed roofing work.

1.9 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Provide manufacturer's Total Roofing System Warranty, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.
 - 1. Special warranty includes roofing membrane, insulation, cover boards, base flashings, roofing accessories including adhesives, sealants, fasteners and plates, metal edgings and copings, and other components of membrane roofing system.
 - 2. Warranty period is 10 years materials and labor after date of final completion, and 5 additional years for roofing membrane.
 - 3. Submit a sample copy of roofing warranty which will be executed upon completion of the Work, prior to award of the contract.
 - 4. This warranty shall not deprive the Owner of other rights the Owner may have under of the provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

- C. Correct defective work within a two year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. EPDM Membrane Materials:
1. Carlisle Roofing Systems, Inc: www.carlisle-syntec.com/#sle.
 2. Firestone Building Products: www.firestonebpco.com/#sle.
 3. GenFlex Roofing Systems, LLC: www.genflex.com/#sle.
 4. Johns Manville: www.jm.com/#sle.
 5. Mule-Hide Products Co, Inc: www.mulehide.com/#sle.
 6. Versico Roofing Systems: www.versico.com/#sle.
 7. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Insulation:
1. Dow: www.dow.com/#sle.
 2. GAF: www.gaf.com/#sle.
 3. Johns Manville; _____: www.jm.com/#sle.
 4. Owens Corning Corporation: www.owenscorning.com/#sle.
 5. Versico Roofing Systems; SecurShield Insulation: www.versico.com/#sle.

2.2 ROOFING

- A. Elastomeric Membrane Roofing: One ply membrane, fully adhered, over vapor retarder and insulation.
- B. Roofing Assembly Requirements:
1. Roof-Ceiling Fire Resistance Rating: Comply with UL (FRD) certified Assembly Design No. _____.
 2. Factory Mutual Classification: Class 1 and windstorm resistance of 1-90, in accordance with FM DS 1-28.
 3. Insulation Thermal Resistance (R-Value): 5.6 per inch, minimum; provide insulation of thickness required.
- C. Acceptable Insulation Types - Constant Thickness Application: Any of types specified.
1. Minimum 2 layers of polyisocyanurate board.
- D. Acceptable Insulation Types - Tapered Application: Any of types specified.
1. Uniform thickness composite or polyisocyanurate board covered with tapered polyisocyanurate board.

2.3 ROOFING MEMBRANE AND ASSOCIATED MATERIALS

- A. Membrane: Ethylene-propylene-diene-monomer (EPDM); non-reinforced; complying with minimum properties of ASTM D4637/D4637M.
1. Thickness: 60 mil, 0.060 inch.
 2. Sheet Width: 76 inches, maximum.
 3. Color: White.
- B. Seaming Materials: As recommended by membrane manufacturer.
- C. Membrane Fasteners: As recommended by and approved by membrane manufacturer.
- D. Vapor Retarder: Reinforced Kraft paper laminate, complying with requirements of fire rating classification; compatible with roofing and insulation materials.
1. Fire-retardant adhesive.
- E. Flexible Flashing Material: Same material as membrane.

2.4 COVER BOARDS

- A. Cover Boards: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.
 - 1. 1/2 inch thick, factory primed.
 - 2. Products:
 - a. Georgia-Pacific; DensDeck: www.densdeck.com/#sle.
 - b. CertainTeed Corporation..
 - c. National Gypsum Company.
 - d. United States Gypsum Company.

2.5 INSULATION

- A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
 - 1. Classifications:
 - a. Type II: Faced with either cellulosic facers or glass fiber mat facers on both major surfaces of the core foam.
 - 1) Class 1 - Faced with glass fiber reinforced cellulosic facers on both major surfaces of the core foam.
 - 2) Compressive Strength: Classes 1-2-3, Grade 1 - 16 psi (110 kPa), minimum.
 - 3) Thermal Resistance, R-value: At 1-1/2 inches thick; Class 1, Grades 1-2-3 - 8.4 (1.48) at 75 degrees F.
 - 2. Board Size: 48 by 96 inches.
 - 3. Board Thickness: 1.5 inch.
 - 4. Tapered Board: Slope as indicated; minimum thickness 1/2 inch; fabricate of fewest layers possible.
 - 5. Board Edges: Square.

2.6 ACCESSORIES

- A. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.
- B. Insulation Joint Tape: Glass fiber reinforced type as recommended by insulation manufacturer, compatible with roofing materials; 6 inches wide; self adhering.
- C. Insulation Fasteners: Appropriate for purpose intended and approved by Factory Mutual and roofing manufacturer.
- D. Membrane Adhesive: As recommended by membrane manufacturer.
- E. Insulation Adhesive: As recommended by insulation manufacturer.
- F. Sealants: As recommended by membrane manufacturer.
- G. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
 - 1. Size: Manufacturer's standard size(s).
 - 2. Surface Color: White.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces and site conditions are ready to receive work.
- B. Verify deck is supported and secure.
- C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
- D. Verify deck surfaces are dry and free of snow or ice.

- E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.
- F. Beginning installation means acceptance of existing substrate.

3.2 PREPARATION - WOOD DECK

- A. Verify flatness and tightness of joints in wood decking; fill knot holes with latex filler.

3.3 INSTALLATION - INSULATION, UNDER MEMBRANE

- A. Install vapor retarder to deck surface with adhesive in accordance with manufacturer's instructions.
 - 1. Extend vapor retarder under cant strips and blocking to deck edge.
 - 2. Install flexible flashing from vapor retarder to air seal material of wall construction, lap and seal to provide continuity of the air barrier plane.
- B. Ensure vapor retarder is clean and dry, continuous, and ready for application of insulation.
- C. Attachment of Insulation: Embed insulation in adhesive in full contact, in accordance with roofing and insulation manufacturers' instructions.
- D. Cover Boards: Mechanically fasten cover boards in accordance with roofing manufacturer's instructions and FM (AG) Factory Mutual requirements.
 - 1. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.
- E. Lay subsequent layers of insulation with joints staggered minimum 6 inches from joints of preceding layer.
- F. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.
- G. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
- H. Tape joints of insulation in accordance with roofing and insulation manufacturers' instructions.
- I. Do not apply more insulation than can be covered with membrane in same day.

3.4 INSTALLATION - MEMBRANE

- A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching. Allow to relax before installing.
- B. Shingle joints on sloped substrate in direction of drainage.
- C. Fully Adhered Application: Apply adhesive to substrate at rate required by manufacturer. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.
- D. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.
- E. Mechanical Attachment: Install membrane and mechanical attachment devices in accordance with manufacturer's instructions.
- F. At intersections with vertical surfaces:
 - 1. Extend membrane over cant strips and up a minimum of 4 inches onto vertical surfaces.
 - 2. Fully adhere flexible flashing over membrane and up to nailing strips.
- G. Around roof penetrations, seal flanges and flashings with flexible flashing.
- H. Coordinate installation of roof drains and sumps and related flashings.
- I. Coordinate installation of associated counterflashings installed under other sections.

- J. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

- K. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.

3.5 INSTALLATION - MEMBRANE FINISH COATING/COVER

- A. Install walkway pads. Space pad joints to permit drainage.

3.6 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Provide daily on-site attendance of roofing and insulation manufacturer's representative during installation of this work.

3.7 CLEANING

- A. See Section 01 70 00 - Execution Requirements for additional requirements.
- B. Remove bituminous markings from finished surfaces.
- C. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.
- D. Repair or replace defaced or damaged finishes caused by work of this section.

3.8 PROTECTION

- A. Protect installed roofing and flashings from construction operations.
- B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

3.9 INSPECTION AND WARRANTY

- A. Upon completion of the installation, an inspection shall be made by a representative of the roofing manufacturer to ascertain that the roofing system has been installed according to the manufacturer's published specifications and details.
- B. Warranty to be issued upon approval of the installation.

END OF SECTION

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

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

1.2 REFERENCE STANDARDS

- A. AAMA 611 - Specification for Anodized Architectural Aluminum; 2024.
- B. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
- C. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).
- E. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2024).
- F. CDA A4050 - Copper in Architecture - Handbook; Current Edition.
- G. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct at Project site.

1.4 SUBMITTALS

- A. See Section 01 31 50 - Submittals for submittal procedures.
- B. Products and materials specified in this Section are subject to the Build America, Buy America (BABA) requirements described in Division 01. Submit BABA Compliance Documentation demonstrating that products comply with HUD BABA requirements prior to procurement. Products not meeting BABA requirements shall not be incorporated into the Work.
- C. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- D. Samples: For each exposed product and for each color and texture specified.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.
- B. Fabricator and Installer Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
 - 1. For copings and roof edge flashings that are SPRI ES-1 tested, shop shall be listed as able to fabricate required details as tested and approved.

1.6 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:
 - 1. Design Pressure: As indicated on Drawings.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET MATERIALS

- A. Anodized Aluminum: ASTM B209/B209M, 3005 alloy, H12 or H14 temper; 0.032 inch thick; clear anodized finish.
 - 1. Clear Anodized Finish: AAMA 611, AA-M12C22A41, Class I, clear anodic coating not less than 0.7 mil, 0.0007 inch thick.
- B. Stainless Steel: ASTM A666/A666M, Type 304 alloy, soft temper, 28 gauge, 0.0156 inch thick; smooth No. 4 - Brushed finish.

2.3 FABRICATION

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 - 1. Obtain field measurements for accurate fit before shop fabrication.
 - 2. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 - 3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- C. Fabricate cleats of same material as sheet, of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured., interlocking with sheet.
- D. Form pieces in longest possible lengths.
- E. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- F. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

- G. Tin edges of copper sheet to be soldered; solder shop formed metal joints, and after soldering, remove flux, wipe and wash solder joints clean; provide weathertight joints.
- H. Fabricate corners from one piece with minimum 18-inch long legs; seam for rigidity, seal with sealant.
- I. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
- J. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.
- K. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

2.4 GUTTERS AND DOWNSPOUTS

- A. Gutters: SMACNA (ASMM) Rectangular profile.
- B. Downspouts: Rectangular profile.
- C. Gutters and Downspouts: Size indicated on drawings.
- D. Accessories: Profiled to suit gutters and downspouts.
 - 1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
 - 2. Downspout Supports: Straps.
 - 3. Gutter Accessory: Continuous, removable leaf screen with sheet metal frame and hardware cloth screen.
- E. Downspout Boots: Plastic. Where indicated on Civil drawings.
- F. Seal metal joints.

2.5 Flashing

- A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.
- B. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12-foot-long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch-high, end dams. Fabricate from Stainless Steel.
- C. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams. Fabricate from Anodized Aluminum.

2.6 ACCESSORIES

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

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

3.3 UNDERLAYMENT INSTALLATION

- A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.
- B. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, according to manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.
- C. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller. Cover underlayment within 14 days.

3.4 INSTALLATION

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 - 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 - 5. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
 - 1. Coat concealed side of uncoated-aluminum sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Wall Flashing Installation: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

- D. Opening Flashings in Frame Construction: Install continuous head, sill, and similar flashings to extend 4 inches beyond wall openings.
 - E. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
 - F. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws. For manufactured items not less than recommended by fastener manufacturer to achieve maximum pull-out resistance
 - G. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
 - H. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work.
 - 1. Retain metals in first subparagraph below that are specified in Part 2; revise to suit Project. Soldering requires removal of painted, coated, or lacquered finishes. Although unusual, zinc-coated (galvanized) steel, a type of metallic-coated steel, may be soldered.
 - 2. Do not solder metallic-coated steel and aluminum sheet.
 - 3. Do not use torches for soldering.
 - 4. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
 - 5. Stainless-Steel Soldering: Tin edges of uncoated sheets, using solder for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
 - I. Rivets: Rivet joints in uncoated aluminum where necessary for strength.
 - J. Connect downspouts to downspout boots, and grout connection watertight.
- 3.5 CLEANING AND PROTECTION
- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
 - B. Clean and neutralize flux materials. Clean off excess solder.
 - C. Clean off excess sealants.
 - D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION

SECTION 07 71 00 - ROOF SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Manufactured roof specialties, including copings and fascias.

1.2 RELATED REQUIREMENTS

- A. Section 07 72 00 - Roof Accessories: Manufactured curbs, roof hatches, and snow guards.

1.3 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- B. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems; 2022.
- C. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2024).
- D. NRCA (RM) - The NRCA Roofing Manual; 2025.
- E. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.4 SUBMITTALS

- A. See Section 01 for submittal procedures.
- B. Products and materials specified in this Section are subject to the Build America, Buy America (BABA) requirements described in Division 01. Submit BABA Compliance Documentation demonstrating that products comply with HUD BABA requirements prior to procurement. Products not meeting BABA requirements shall not be incorporated into the Work.
- C. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.
- D. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.
- E. Samples: For each type of roof specialty and for each color and texture specified submit a sample illustrating component shape, finish, and color.
- F. Maintenance Data: For roofing specialties to include in maintenance manuals.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. FM Approvals' Listing: Manufacture and install copings and roof-edge specialties that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with FM Approvals' markings.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 COMPONENTS

- A. Roof Edge Flashings: Factory fabricated to sizes required; corners mitered; concealed fasteners.
 1. Configuration: Fascia, cant, and edge securement for roof membrane.
 2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test methods RE-1 and RE-2 to positive and negative design wind pressure as defined by applicable local building code.
 3. Material: Formed aluminum sheet, 0.050 inch thick, minimum.
 4. Color: As selected by Architect from manufacturer's standard range.
- B. Copings: Factory fabricated to sizes required; corners mitered; concealed fasteners.
 1. Configuration: Concealed continuous hold down cleat at both legs; internal splice piece at joints of same material, thickness, and finish as cap; concealed stainless steel fasteners.
 2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-3 to positive and negative design wind pressure as defined by applicable local building code.
 3. Wall Width: As indicated on drawings.
 4. Material: Formed aluminum sheet, 0.040 inch thick, minimum.
 5. Color: As selected by Architect from manufacturer's standard range.
- C. Pipe and Penetration Flashing: Base of rounded aluminum, compatible with sheet metal roof systems, and capable of accommodating pipes sized between 3/8 inch and 12 inches.
 1. Caps: EPDM.
 2. Color: As indicated on drawings.
- D. Roof Penetration Sealing Systems: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.

2.3 FINISHES

- A. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; color as indicated.

2.4 ACCESSORIES

- A. Sealant for Joints in Linear Components: As recommended by component manufacturer.
- B. Adhesive for Anchoring to Roof Membrane: Compatible with roof membrane and approved by roof membrane manufacturer.
- C. Insulation Board Adhesive: Two-component, low-rise polyurethane foam adhesive used for adhering insulation to low slope roof deck materials.
- D. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that deck, curbs, roof membrane, base flashing, and other items affecting work of this Section are in place and positioned correctly.
 1. See Section 07 72 00 for information on roofing related accessories.

3.2 INSTALLATION

- A. Install components in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

- B. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
 - 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
 - 3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 - 4. Torch cutting of roof specialties is not permitted.
 - 5. Do not use graphite pencils to mark metal surfaces.
 - C. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
 - D. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
 - 1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise indicated on Drawings.
 - 2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
 - E. Fastener Sizes: Use fasteners of sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
 - F. Seal joints within components when required by component manufacturer. Do not install sealants at temperatures below 40 deg F.
 - G. Anchor components securely.
 - H. Coordinate installation of components of this section with installation of roofing membrane and base flashings.
 - I. Coordinate installation of sealants and roofing cement with work of this section to ensure water tightness.
 - J. Coordinate installation of flashing flanges into reglets.
- 3.3 CLEANING AND PROTECTION
- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
 - B. Remove temporary protective coverings and strippable films as roof specialties are installed.

END OF SECTION

SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Roof hatches.

1.2 RELATED REQUIREMENTS

- A. Section 07 71 00 - Roof Specialties: Other manufactured roof specialty items.

1.3 SUBMITTALS

- A. See Section 01 31 50 - Submittals for submittal procedures.
- B. Products and materials specified in this Section are subject to the Build America, Buy America (BABA) requirements described in Division 01. Submit BABA Compliance Documentation demonstrating that products comply with HUD BABA requirements prior to procurement. Products not meeting BABA requirements shall not be incorporated into the Work.
- C. Product Data: Manufacturer's data sheets on each product to be used.
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Maintenance requirements.
- D. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.
 - 1. Snow Guards: Submit design calculations for loadings and spacings based on manufacturer testing.
- E. Warranty Documentation:
 - 1. Submit manufacturer warranty.
 - 2. Ensure that forms have been completed in Owner's name and registered with manufacturer.
 - 3. Submit documentation that roof accessories are acceptable to roofing manufacturer, and do not limit the roofing warranty.
- F. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store products under cover and elevated above grade.

PART 2 PRODUCTS

2.1 ROOF HATCHES AND VENTS

- A. Roof Hatch Manufacturers:
 - 1. Activar Construction Products Group, Inc. - JL Industries; Diamond Series Roof Hatches, Model RHDG: www.activarcpg.com/#sle.
 - 2. Acudor Products Inc; Galvanized Steel Roof Hatch: www.acudor.com/#sle.
 - 3. Babcock-Davis; Personnel: www.babcockdavis.com/#sle.
 - 4. Bilco Company; Type TB (various types and special size): www.bilco.com/#sle.
 - 5. Precision Ladders, LLC; Model PH-A: www.precisionladders.com/#sle.
 - 6. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.
- B. Fastener Sizes: Use fasteners of sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

3.4 CLEANING

- A. Clean installed work to like-new condition.
- B. Remove temporary protective coverings and strippable films as roof specialties are installed.

3.5 PROTECTION

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

SECTION 07 81 00 - APPLIED FIRE PROTECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Applied fire protection of interior structural steel not exposed to damage or moisture.
- B. Preparation of applied fire protection for application of exposed overcoat finish specified elsewhere.

1.2 RELATED REQUIREMENTS

- A. Structural Steel Framing specifications found on the Structural Drawings.
- B. Section 07 84 00 - Firestopping.
- C. Section 09 21 16 - Gypsum Board Assemblies: Gypsum board fireproofing.

1.3 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- B. ASTM E736/E736M - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members; 2019 (Reapproved 2023).
- C. ASTM E759/E759M - Standard Test Method for Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members; 1992 (Reapproved 2023).
- D. ASTM E760/E760M - Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members; 1992 (Reapproved 2023).
- E. ASTM E859/E859M - Standard Test Method for Air Erosion of Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members; 2023.
- F. ASTM E937/E937M - Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 1993 (Reapproved 2023).
- G. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

1.4 ADMINISTRATIVE REQUIREMENTS

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

1.5 SUBMITTALS

- A. See Section 01 31 50 - Submittals, for submittals procedures.
- B. Products and materials specified in this Section are subject to the Build America, Buy America (BABA) requirements described in Division 01. Submit BABA Compliance Documentation demonstrating that products comply with HUD BABA requirements prior to procurement. Products not meeting BABA requirements shall not be incorporated into the Work.
- C. Product Data: Provide data indicating product characteristics.

- D. Manufacturer's Certificate: Certify that applied fireproofing products meet or exceed requirements of Contract Documents.
- E. Test Reports: Reports from reputable independent testing agencies for proposed products, indicating compliance with specified criteria, conducted under conditions similar to those on project, as follows:
 - 1. Bond strength.
 - 2. Bond impact.
 - 3. Compressive strength.
 - 4. Fire tests using substrate materials similar those on project.
- F. Manufacturer's Installation Instructions: Indicate special procedures.
- G. Field Quality Control Submittals: Submit field test report.
- H. Manufacturer's Qualification Statement.
- I. Installer's Qualification Statement.
- J. Submit schedule of thicknesses for each member with reference to UL Designs.

1.6 QUALITY ASSURANCE

- A. Products execution and fireproofing thicknesses shall conform to the applicable code and UL requirements for the required fire resistance ratings.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience and approved by manufacturer

1.7 MOCK-UP

- A. Construct mock-up, 100 square feet in size.
- B. Comply with project requirements for fire ratings.
- C. Locate where directed.
- D. Examine installation within one hour of application to determine variances from specified requirements due to shrinkage, temperature, and humidity.
- E. Where shrinkage and cracking are evident, adjust mixture and method of application as necessary; remove materials and re-construct mock-up.
- F. Mock-up may remain as part of the Work.

1.8 FIELD CONDITIONS

- A. Do not apply fireproofing when temperature of substrate material and surrounding air is below 40 degrees F 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.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Applied Fire Protection:
 - 1. GCP Applied Technologies; _____: www.gcpat.com/#sle.
 - 2. Isolatek International Corp; _____: www.isolatek.com/#sle.

3. Southwest Fireproofing Products Company; ____: www.sfrm.com/#sle.
4. Carboline Company; a subsidiary of RPM International.
5. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 APPLIED FIRE PROTECTION ASSEMBLIES

- A. Provide assemblies as indicated on drawings.

2.3 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, minimum, when tested in accordance with ASTM E736/E736M when set and dry.
 2. Compressive Strength: 8.33 pounds per square inch, 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. Air Erosion Resistance: Weight loss of 0.025 g/sq ft, maximum, when tested in accordance with ASTM E859/E859M after 24 hours.
 6. 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.
 7. Effect of Deflection: No cracking, spalling, or delamination, when tested in accordance with ASTM E759/E759M.
 8. Fungal Resistance: No growth after 28 days when tested according to ASTM G21.
 - a. Treat products with manufacturer's standard antimicrobial formulation

2.4 ACCESSORIES

- A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Primer ____: Of type recommended by applied fire protection manufacturer.
- C. Overcoat: As recommended by manufacturer of applied fire protection material.
- D. Water: Clean, potable.

PART 3 EXECUTION

3.1 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.

3.2 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.

3.3 APPLICATION

- A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.
- B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- C. Apply primer adhesive in accordance with manufacturer's instructions.
- D. Apply fireproofing in uniform thickness and density as necessary to achieve required ratings.
- E. Apply overcoat at the rate recommended by fireproofing manufacturer.

3.4 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 40 00 - Quality Requirements.
- B. Inspect installed fireproofing after application and curing for integrity, prior to its concealment.
- C. Ensure that actual thicknesses, densities, and bond strengths meet requirements for specified ratings and requirements of authorities having jurisdiction (AHJ).
- D. Repair or replace applied fireproofing at locations where test results indicate fireproofing does not meet specified requirements.
- E. Re-inspect installed fireproofing for integrity of fire protection, after installation of subsequent Work.

3.5 CLEANING, PROTECTING AND REPAIRING

- A. Remove excess material, overspray, droppings, and debris.
- B. Remove fireproofing from materials and surfaces not required to be fireproofed.
- C. Repair fireproofing damaged by other work before concealing it with other construction.
- D. Repair fireproofing by reapplying it using same method as original installation

END OF SECTION

SECTION 07 84 00 - FIRESTOPPING

PART 1 GENERAL

1.1 SECTION INCLUDES

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

1.2 RELATED REQUIREMENTS

- A. Section 09 21 16 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.3 REFERENCE STANDARDS

- A. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems; 2024.
- B. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2024.
- C. FM 4991 - Approval Standard of Firestop Contractors; 2013.
- D. UL (FRD) - Fire Resistance Directory; Current Edition.

1.4 SUBMITTALS

- A. See Section 01 31 50 - Submittals for submittal procedures.
- B. Products and materials specified in this Section are subject to the Build America, Buy America (BABA) requirements described in Division 01. Submit BABA Compliance Documentation demonstrating that products comply with HUD BABA requirements prior to procurement. Products not meeting BABA requirements shall not be incorporated into the Work.
- C. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- D. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Manufacturer's qualification statement.
- G. Installer's qualification statement.

1.5 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) will be considered as constituting an acceptable test report.
- B. Installer Qualifications: Company specializing in performing the work of this section and:
 - 1. Approved by Factory Mutual Research Corporation under FM 4991, or meeting any two of the following requirements:
 - 2. Verification of minimum three years documented experience installing work of this type.
 - 3. Verification of at least five satisfactorily completed projects of comparable size and type.
 - 4. Licensed by local authorities having jurisdiction (AHJ).
- C. Preinstallation Conference: Conduct conference at Project site.

1.6 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
- B. Coordination With Other Trades: Coordinate annular space, sleeve and insulation requirements with work of Divisions 21 through 28.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Firestopping Manufacturers:
 - 1. 3M Fire Protection Products; _____: www.3m.com/firestop/#sle.
 - 2. A/D Fire Protection Systems Inc; _____: www.adfire.com/#sle.
 - 3. CEMCO; HOTROD Type-X Compressible Firestopping: www.cemcosteel.com/#sle.
 - 4. Everkem Diversified Products, Inc; Intumescent Fire-Rated Putty Pads: www.everkemproducts.com/#sle.
 - 5. Fire Shield, LLC; Barri-Ring: www.fireshieldlv.com/#sle.
 - 6. Grabber Construction Products, Inc; GrabberGard EFC: www.grabberman.com/#sle.
 - 7. HoldRite, a Brand of Reliance Worldwide Corporation; HydroFlame: www.holdrite.com/#sle.
 - 8. MarinoWARE; _____: www.marinoware.com/#sle.
 - 9. Nelson FireStop Products; _____: www.nelsonfirestop.com/#sle.
 - 10. Passive Fire Protection Partners; Firestop 3600EX: www.firestop.com/#sle.
 - 11. RectorSeal, a CSW Industrials Company; Metacaulk 150+ General Purpose Firestop Sealant: www.rectorseal.com/firestop-solutions/#sle.
 - 12. Specified Technologies Inc; _____: www.stifirestop.com/#sle.
 - 13. Tremco Commercial Sealants & Waterproofing; TREMstop Acrylic: www.tremcosealants.com/#sle.
 - 14. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 MATERIALS

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

2.3 FIRESTOPPING SYSTEMS

- A. Firestopping: Any material meeting requirements.
 - 1. Fire Ratings: See drawings for required systems and ratings.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping system.
- C. Install fill materials by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by joints, openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
 - 2. Apply fill materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
- D. Do not cover installed firestopping until inspected by Owner's Independent Testing Agency.
- E. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- F. Install permanent Wall Identification at walls containing firestopping systems and label all penetration and joint firestopping systems as required by code.

3.4 FIELD QUALITY CONTROL

- A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174 and ASTM E2393.
- B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.
- C. Proceed with enclosing firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.5 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

3.6 PROTECTION

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

END OF SECTION

SECTION 07 92 00 - JOINT SEALANTS

PART 1 GENERAL

1.1 SECTION INCLUDES

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

1.2 RELATED REQUIREMENTS

- A. Section 09 21 16 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
- B. Section 09 30 00 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

1.3 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 C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2024.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).
- E. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2023.
- F. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.
- G. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2022.
- H. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2019 (Reapproved 2025).
- I. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

1.4 SUBMITTALS

- A. See Section 01 31 50 - Submittals for submittal procedures.
- B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 4. Substrates the product should not be used on.
- C. 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. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.
- F. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.
- G. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.
- H. Field Quality Control Plan: Submit at least two weeks prior to start of installation.
- I. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.
- J. Installation Log: Submit filled-out log for each length or instance of sealant installed.
- K. Field Quality Control Log: Submit filled-out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.
- B. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
 - 1. Adhesion Testing: In accordance with ASTM C794.
 - 2. Compatibility Testing: In accordance with ASTM C1087.
 - 3. Allow sufficient time for testing to avoid delaying the work.
 - 4. Deliver sufficient samples to manufacturer for testing.
 - 5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
- C. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.
 - 1. Identification of testing agency.
 - 2. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
 - a. Test date.
 - b. Copy of test method documents.
 - c. Age of sealant upon date of testing.
 - d. Test results, modeled after the sample form in the test method document.
 - e. Indicate use of photographic record of test.
- D. Field Quality Control Plan:
 - 1. Visual inspection of entire length of sealant joints.
 - 2. Destructive field adhesion testing of sealant joints, except interior acrylic latex sealant.
 - a. For each different sealant and substrate combination, allow for one test every 100 feet in the first 1,000 linear feet, and one test per 1,000 linear feet thereafter, or once per floor on each elevation.
 - b. If any failures occur in the first 1,000 linear feet, continue testing at frequency of one test per 500 linear feet at no extra cost to Owner.
 - 3. Field testing agency's qualifications.
 - 4. Field Quality Control Log Form: Show same data fields as on Preinstallation Field Adhesion Test Log, with known information filled out and lines for multiple tests per sealant/substrate combinations; include visual inspection and specified field testing; allow for possibility that more tests than minimum specified may be necessary.
- E. Field Adhesion Test Procedures:
 - 1. Allow sealants to fully cure as recommended by manufacturer before testing.

2. Have a copy of the test method document available during tests.
 3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
 4. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
 5. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.
 6. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.
- F. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.
1. Sample: At least 18 inches long.
 2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch by that percentage; if adhesion failure occurs before the 1-inch mark is that distance from the substrate, the test has failed.
 3. If either adhesive or cohesive failure occurs before minimum elongation, take necessary measures to correct conditions and retest; record each modification to products or installation procedures.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Nonsag Sealants:
1. Adfast USA Inc; ____: www.adfastcorp.com/#sle.
 2. Bostik Inc; ____: www.bostik-us.com/#sle.
 3. Dow: www.dow.com/#sle.
 4. Everkem Diversified Products, Inc; ____: www.everkemproducts.com/#sle.
 5. Master Builders Solutions: www.master-builders-solutions.com/en-us/#sle.
 6. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com/#sle.
 7. Pecora Corporation: www.pecora.com/#sle.
 8. Sherwin-Williams Company; ____: www.sherwin-williams.com/#sle.
 9. Sika Corporation: www.usa.sika.com/#sle.
 10. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
 11. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Self-Leveling Sealants:
1. Bostik Inc; ____: www.bostik-us.com/#sle.
 2. Dayton Superior Corporation; ____: www.daytonsuperior.com/#sle.
 3. Dow; ____: www.dow.com/#sle.
 4. Master Builders Solutions: www.master-builders-solutions.com/en-us/#sle.
 5. Pecora Corporation; ____: www.pecora.com/#sle.
 6. Sherwin-Williams Company; ____: www.sherwin-williams.com/#sle.
 7. Sika Corporation; ____: usa.sika.com/#sle.
 8. Tremco Commercial Sealants & Waterproofing; ____: www.tremcosealants.com/#sle.
 9. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 JOINT SEALANT APPLICATIONS

- A. Scope:
1. Do Not Seal:
 - a. Intentional weep holes in masonry.
 - b. Joints indicated to be covered with expansion joint cover assemblies.
 - c. Joints where sealant is specified to be furnished and installed by manufacturer of product to be sealed.
 - d. Joints where sealant installation is specified in other sections.
 - e. Joints between suspended ceilings and walls.

- B. Type ____ - Exterior Joints: Use nonsag nonstaining silicone sealant, unless otherwise indicated.
- C. Type ____ - Interior Joints: Use nonsag polyurethane sealant, unless otherwise indicated.
 - 1. Type ____ - Joints between Tile in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
 - 2. Type ____ - In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
- D. Interior Wet Areas: Bathrooms, restrooms, kitchens, food service areas, food processing areas, and ____; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, other similar items, and ____.
- E. Sound-Rated Assemblies: Walls and ceilings identified as STC-rated, sound-rated, or acoustical.

2.3 JOINT SEALANTS - GENERAL

- A. Only use sealant and primers that comply with the following limits for VOC content:
 - 1. Architectural Sealants: 250 g/L.
 - 2. Roofing Sealants: 450 g/L.
 - 3. Roadway Sealants: 250 g/L.
 - 4. Sealant primer: 250 g/L.
- B. Colors: As selected by Architect from manufacturer's full range.

2.4 NONSAG JOINT SEALANTS

- A. Type SC - 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. Cure Type: Mildew-resistant acetoxycuring.
 - 3. Products:
 - a. Dow; DOWSIL 758 Silicone Weather Barrier Sealant: www.dow.com/#sle.
 - b. Momentive Performance Materials, Inc/GE Silicones; SCS2700 SilPruf LM (Low Modulus) - Silicone Weatherproofing Sealant: www.siliconeforbuilding.com/#sle.
 - c. Pecora Corporation; Pecora 860: www.pecora.com/#sle.
 - d. Sika Corporation; Sikasil WS-295: usa.sika.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
 - 4. Use for all exterior joints in or between PVC materials, interior vertical joints which penetrate concrete of masonry and vertical joints between masonry and other materials.
- B. Type SM - 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: White or Clear.
 - 2. Products:
 - a. Pecora Corporation; Pecora 898 NST (Non-Staining Technology): www.pecora.com/#sle.
 - b. Sika Corporation; Sikasil GP: usa.sika.com/#sle.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
 - 3. Use for all horizontal and vertical joints between plumbing fixtures and adjoining walls, floors, and counters and tile control and expansion joints where indicated.
- C. Type SF - Food Contact Silicone Sealant: ASTM C920, One component silicone rubber, acceptable to local health officials, conforming to U.S. Food and Drug Administration regulation 21 CFR 175.105 and 175.300, FS TT-S-001543A, Type Non-Sag, Class A. Type NS, Class 25, Use NT, G, O and A
 - 1. Movement Capability: Plus and minus 25 percent, minimum.
 - 2. Hardness Minimum: 20, Shore A, when tested in accordance with ASTM C661.
 - 3. Manufacturers:
 - a. Dow; DowSil 732.
 - b. GE Silicones; SCS1000.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
 - 4. Use for all interior applications with food contact.

- D. Type P2 - Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface.
 - 1. Movement Capability: Plus and minus 25 percent, minimum.
 - 2. Products:
 - a. Sika Corporation; Sikaflex-2c NS EZ Mix+: usa.sika.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Type B - Butyl Sealant: Solvent-based; ASTM C1311; single component, nonsag; not expected to withstand continuous water immersion or traffic.
 - 1. Hardness Range: 10 to 30, Shore A, when tested in accordance with ASTM C661.
 - 2. Products:
 - a. Pecora Corporation; Pecora BC-158 Butyl Rubber Sealant: www.pecora.com/#sle.
 - b. Sherwin-Williams Company; Storm Blaster All Season Sealant: www.sherwin-williams.com/#sle.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
 - 3. Use for bedding of thresholds

2.5 SELF-LEVELING JOINT SEALANTS

- A. Type HL-1 - Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .
 - 1. Movement Capability: Plus and minus 25 percent, minimum.
 - 2. Products:
 - a. Pecora Corporation; Urexspan NR-201: www.pecora.com/#sle.
 - b. Sherwin-Williams Company; Stampede 1SL Polyurethane Sealant: www.sherwin-williams.com/#sle.
 - c. Sherwin-Williams Company; Stampede 2SL Polyurethane Sealant: www.sherwin-williams.com/#sle.
 - d. Sika Corporation; Sikaflex-1c SL: usa.sika.com/#sle.
 - e. Sika Corporation; Sikaflex-2c SL: usa.sika.com/#sle.
 - f. Tremco Commercial Sealants & Waterproofing; Vulkem 45 SSL.
 - g. Substitutions: See Section 01 60 00 - Product Requirements.
 - 3. Use for all interior joints in floor.
- B. Type HL-2 - Self-Leveling Polyurethane Sealant for Horizontal Expansion Joints: ASTM C920, Grade P, Uses T, M, and O; multi-component; explicitly approved by manufacturer for horizontal expansion joints.
 - 1. Movement Capability: Plus and minus 25 percent, minimum.
 - 2. Hardness Range: 30 to 35, Shore A, when tested in accordance with ASTM C661.
 - 3. Products:
 - a. Pecora Corporation; Urexspan NR-200: www.pecora.com/#sle.
 - b. Tremco Commercial Sealants & Waterproofing; ____: www.tremcosealants.com/#sle.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
 - 4. Use for all exterior joints subject to traffic and interior floor joints at exterior building walls.
- C. Type FS - Flexible Polyurethane Foam: Single-component, gun grade, and low-expanding.
 - 1. Products:
 - a. DAP Products Inc; DRAFTSTOP 812 Foam: www.dapspecline.com/#sle.
 - b. Tremco Commercial Sealants & Waterproofing; ExoAir LEF: www.tremcosealants.com/#sle.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Type HL-3 - Semi-Self-Leveling Polyurethane Sealant: Intended for expansion joints in sidewalks, swimming pool decks, plazas, floors and other horizontal surfaces with up to 6 percent slope.
 - 1. Composition: Single or multicomponent.
 - 2. Durometer Hardness, Type A: 35 to 45, minimum, when tested in accordance with ASTM D2240.
 - 3. Products:
 - a. Tremco Commercial Sealants & Waterproofing; Vulkem 45 SSL: www.tremcosealants.com/#sle.

- b. Tremco Commercial Sealants & Waterproofing; Vulkem 445 SSL:
www.tremcosealants.com/#sle.
- c. Substitutions: See Section 01 60 00 - Product Requirements.

2.6 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. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
 - 2. Manufacturers:
 - a. ADFAST Corporation; ADSEAL BR-2600 (Backer Rod): www.adfastcorp.com/#sle.
 - b. Nomaco, Inc; Construction Foam Products: www.nomaco.com/#sle.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- 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

3.1 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.
- D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
 - 1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
 - 2. Notify Architect of date and time that tests will be performed, at least seven days in advance.
 - 3. Record each test on Preinstallation Adhesion Test Log as indicated.
 - 4. If any sample fails, review products and installation procedures, consult manufacturer, or take other measures that are necessary to ensure adhesion; retest in a different location; if unable to obtain satisfactory adhesion, report to Architect.
 - 5. After completion of tests, remove remaining sample material and prepare joints for new sealant installation.

3.2 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.

3.3 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. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- E. Install bond breaker backing tape where backer rod cannot be used.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- G. 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.
- H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.4 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.
- C. Destructive Adhesion Testing: If there are any failures in first 1,000 linear feet, notify Architect immediately.
- D. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.
- E. Repair destructive test location damage immediately after evaluation and recording of results.

END OF SECTION

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for wood doors.
- C. Fire-rated hollow metal doors and frames.
- D. Thermally insulated hollow metal doors with frames.
- E. Hollow metal borrowed lites glazing frames.
- F. Accessories, including glazing and matching panels.

1.2 RELATED REQUIREMENTS

- A. Section 08 71 00 - Door Hardware.
- B. Section 08 88 13 - Fire Rated Glazing : Glass for doors and borrowed lites.
- C. Section 09 91 13 - Exterior Painting: Field painting.
- D. Section 09 91 23 - Interior Painting: Field painting.

1.3 ABBREVIATIONS AND ACRONYMS

- A. HMMA: Hollow Metal Manufacturers Association.
- B. NAAMM: National Association of Architectural Metal Manufacturers.
- C. SDI: Steel Door Institute.

1.4 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.5 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; 2024.
- 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; 2025.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.
- 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; 2025.

- 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. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- K. ITS (DIR) - Directory of Listed Products; Current Edition.
- L. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2024.
- M. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.
- N. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2025.
- O. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.
- P. UL (DIR) - Online Certifications Directory; Current Edition.
- Q. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- R. UL 1784 - Standard for Air Leakage Tests of Door Assemblies and Other Opening Protectives; Current Edition, Including All Revisions.

1.6 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Products and materials specified in this Section are subject to the Build America, Buy America (BABA) requirements described in Division 01. Submit BABA Compliance Documentation demonstrating that products comply with HUD BABA requirements prior to procurement. Products not meeting BABA requirements shall not be incorporated into the Work.
- C. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.
- D. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- E. Samples: For units with factory applied color finishes: Submit two samples of metal, 2 by 2 inches in size, showing factory finishes, colors, and surface texture.
- F. Schedule: Prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Provide hollow metal doors and frames from SDI Certified manufacturer: <https://steeldoor.org/sdi-certified/#sle>.
- B. Maintain at project site copies of reference standards relating to installation of products specified.

1.8 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

2.1 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. Deansteel Manufacturing Company, Inc; Hollow Metal Doors - SP Series: www.deansteel.com/#sle.
 4. Dunbarton Corporation; Hollow Metal: www.dunbarton.com/#sle.
 5. Krieger Specialty Products; _____: www.kriegerproducts.com/#sle.
 6. Premier Steel Doors and Frames: www.trustpremier.com/#sle.
 7. Pioneer Industries, an Assa Abloy Group company: www.pioneerindustries.com/
 8. Republic Doors, an Allegion brand; ____: www.republicdoor.com/#sle.
 9. Steelcraft, an Allegion brand: www.allegion.com/#sle.
 10. Taylor Entrance Systems; Cambridge: www.taylordoor.com/#sle.
 11. Titan Metal Products, Inc; Builders Series 20 - 90 Minute Doors: www.titanmetalproducts.com/#sle.
 12. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits] indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
- B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 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.
- 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.

2.4 HOLLOW METAL DOORS

- A. Door Finish: Factory primed and field finished.
- B. Exterior Doors: Thermally insulated.
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 3 - Extra Heavy-duty.
 - b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Type: As indicated in the Door and Frame Schedule.
 - d. Model 2 - Seamless.
 - e. Door Face Metal Thickness: 16 gauge, 0.053 inch, minimum.
 - f. Zinc Coating: A 40 /ZF ____ galvanized coating; ASTM A653/A653M.
 2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.

3. Door Thermal Resistance: R-Value of 2.1 when tested according to ASTM C1362
4. Door Thickness: 1-3/4 inches, nominal.
5. Weather Protection: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.

C. Interior Doors, Non-Fire-Rated:

1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 2 - Heavy-duty.
 - b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Type: As indicated in the Door and Frame Schedule.
 - d. Model 1 - Full Flush.
 - e. Door Face Metal Thickness: 20 gauge, 0.032 inch, minimum.
2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
3. Door Thickness: 1-3/4 inches, nominal.

D. Fire-Rated Doors:

1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 2 - Heavy-duty.
 - b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Type: As indicated in the Door and Frame Schedule.
 - d. Model 1 - Full Flush.
 - e. Door Face Metal Thickness: 20 gauge, 0.032 inch, minimum.
2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
3. Provide units listed and labeled by UL (DIR) or ITS (DIR).
 - a. Attach fire rating label to each fire rated unit.
4. Smoke and Draft Control Doors (Indicated with letter "S" on Drawings and/or Door Schedule): Self-closing or automatic closing doors in accordance with NFPA 80 and NFPA 105, with fire-resistance-rated wall construction rated the same or greater than the fire-rated doors, and the following;
 - a. Maximum Air Leakage: 3.0 cfm/sq ft of door opening at 0.10 inch w.g. pressure, when tested in accordance with UL 1784 at both ambient and elevated temperatures.
 - b. Gasketing: Provide gasketing or edge sealing as necessary to achieve leakage limit.
 - c. Label: Include the "S" label on fire-rating label of door.
5. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
6. Door Thickness: 1-3/4 inches, nominal.
7. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated.

2.5 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. Exterior Door Frames: Full profile/continuously welded type.
 1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
 2. Frame Metal Thickness: 16 gauge, 0.053 inch, minimum.
 3. Weatherstripping: Separate, see Section 08 71 00.
- D. Interior Door Frames, Non-Fire Rated: Knock-down type.
 1. Frame Metal Thickness: 16 gauge, 0.053 inch, minimum.
- E. Door Frames, Fire-Rated: Knock-down type.
 1. Fire Rating: Same as door, labeled.
 2. Frame Metal Thickness: 16 gauge, 0.053 inch, minimum.

- F. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
- G. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.
- H. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
- I. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.
- J. Jamb Anchors:
 - 1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
 - 2. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
 - 3. Provide number and spacing of anchors as follows:
 - a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - b. Compression Type: Not less than two anchors in each frame.
 - c. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
- K. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.
 - 3. Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.

2.6 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 dry film thickness (DFT) per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
 - 1. Fire-Rated Frames: Comply with fire rating requirements indicated.

2.7 ACCESSORIES

- A. Glazing: As specified in Section 08 88 13, factory installed.
- B. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.
- C. 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.
- D. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.1 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.

3.2 PREPARATION

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

3.3 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 prefinished frames after painting and wall finishes are complete.
- C. Hollow-Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 - 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
 - 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 - 5. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
 - 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - 7. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
 - 8. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- D. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
 - c. At Bottom of Door: 3/4 inch plus or minus 1/32 inch.
 - d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.

- E. Install fire rated units in accordance with NFPA 80.
- F. Coordinate frame anchor placement with wall construction.
- G. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- H. Install door hardware as specified in Section 08 71 00.
- I. Comply with glazing installation requirements of Section 08 80 00.
 - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.
- J. Coordinate installation of electrical connections to electrical hardware items.
- K. Touch up damaged factory finishes.

3.4 TOLERANCES

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

3.5 ADJUSTING

- A. Adjust for smooth and balanced door movement.
- B. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

3.6 CLEANING

- A. Remove grout and other bonding material from hollow-metal work immediately after installation.
- B. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- C. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

3.7 SCHEDULE

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

END OF SECTION

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

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

1.2 RELATED REQUIREMENTS

- A. Section 06 20 00 - Finish Carpentry: Wood door frames.
- B. Section 08 11 13 - Hollow Metal Doors and Frames.
- C. Section 08 71 00 - Door Hardware.
- D. Section 08 88 13 - Fire Rated Glazing.
- E. Section 09 91 23 - Interior Painting: Field finishing of doors.

1.3 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2025.
- C. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights; 2023.
- D. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.
- E. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2025.
- F. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- G. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2021, with Errata (2022).

1.4 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
- D. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

1.5 QUALITY ASSURANCE

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

1.6 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.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Wood Veneer Faced Doors:
 - 1. Masonite Architectural; Cendura Standard Wood Veneer Doors: www.architectural.masonite.com/#sle.
 - 2. VT Industries, Inc; ____: www.vtindustries.com/#sle.
 - 3. Jeld-wen; <https://www.jeld-wen.com/en-us/products/interior-doors/browse>.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 DOORS AND PANELS

- 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. Exterior Doors: Flush solid core construction and water repellent treated.
 - 1. Thickness: 1-3/4 inches, unless otherwise indicated.
 - 2. Facing: Wood veneer with factory opaque finish.
- C. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
 - 1. Provide solid core doors at each location.
 - 2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
 - 3. Smoke and Draft Control Doors (Indicated as "S" on Drawings): In addition to required fire rating, provide flush wood door assemblies in compliance with WDMA I.S. 1A requirements for "S" label; if necessary, provide additional gasketing or edge sealing.
 - 4. Wood veneer facing with factory opaque finish as indicated on drawings.

2.3 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and 20 Minute 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. Hollow Core Doors: Type - Standard (FSHC); plies and faces as indicated above.

2.4 DOOR FACINGS

- A. Veneer Facing for Opaque Finish: Medium density overlay (MDO), in compliance with indicated quality standard.

2.5 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 and top of door for closer 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.
 - 1. Exception: Doors to be field finished.
- F. Provide edge clearances in accordance with the quality standard specified.

2.6 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: As selected by Architect.
 - c. Sheen: Flat.
 - 2. Opaque:
 - a. Manufacturers standard, in compliance with performance duty level indicated.
 - b. Color: As selected by Architect.
 - c. Sheen: Flat.
- B. Factory finish doors in accordance with approved sample.
- C. Seal door top edge with color sealer to match door facing.

2.7 ACCESSORIES

- A. Wood Door Frames: See Section 06 20 00.
- B. Hollow Metal Door Frames: See Section 08 11 13.
- C. Glazed Openings:
 - 1. Heat-Strengthened and Fully Tempered Glass: ASTM C1048.
 - 2. Fire-Protection-Rated Glass: Safety Certification, 16 CFR 1201, Category II.
 - 3. Glazing: Sealed insulating units, 1 inch thick, made of 1/4 inch glass.
 - 4. Tint: Clear.
 - 5. Coating: Low-E type, on No. 2 surface.
- D. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.
- E. Astragals for Fire-Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge, specifically for double doors.

PART 3 EXECUTION

3.1 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.

3.2 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
 - 1. Install fire-rated doors in accordance with NFPA 80 requirements.
 - 2. Install smoke and draft control doors in accordance with NFPA 105 requirements.
 - 3. Install exterior doors in accordance with ASTM E2112.

- 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.

3.3 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

3.4 SCHEDULE

- A. See Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 08 31 00 - ACCESS DOORS AND PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

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

1.2 RELATED REQUIREMENTS

- A. Section 09 91 23 - Interior Painting: Field paint finish.

1.3 REFERENCE STANDARDS

- A. ITS (DIR) - Directory of Listed Products; Current Edition.
- B. UL (FRD) - Fire Resistance Directory; Current Edition.

1.4 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Products and materials specified in this Section are subject to the Build America, Buy America (BABA) requirements described in Division 01. Submit BABA Compliance Documentation demonstrating that products comply with HUD BABA requirements prior to procurement. Products not meeting BABA requirements shall not be incorporated into the Work.
- C. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

PART 2 PRODUCTS

2.1 ACCESS DOORS AND PANELS ASSEMBLIES

- A. Wall-Mounted Units:
 - 1. Location: As indicated on drawings.
 - 2. Size: 12 by 12 inches.
 - 3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
 - 4. Wall Mounting Criteria: Provide surface-mounted frame concealed by door, with pantograph hinges.
 - 5. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
- B. Fire-Rated Wall-Mounted Units:
 - 1. Location: As indicated on drawings.
 - 2. Wall Fire-Rating: As indicated on drawings.
 - 3. Size: 12 by 12 inches.
 - 4. Door/Panel: Insulated double-surface panel, with tool-operated spring or cam lock and no handle.
- C. Ceiling-Mounted Units:
 - 1. Location: As indicated on drawings.
 - 2. Size - Lay-In Grid Ceilings: To match module of ceiling grid.
 - 3. Size - Other Ceilings: 12 by 12 inches., or as indicated on the drawings.
 - 4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
- D. Fire-Rated Ceiling-Mounted Units:
 - 1. Location: As indicated on drawings.
 - 2. Ceiling Fire-Rating: As indicated on drawings.
 - 3. Size: 12 by 12 inches, or as indicated on the drawings.

4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

2.2 Wall- and Ceiling-MOUNTED ACCESS UNITS

A. Manufacturers:

1. Activar Construction Products Group, Inc. - JL Industries; _____: www.activarcpg.com/#sle.
2. ACUDOR Products Inc; FW-5050-ACF: www.acudor.com/#sle.
3. Babcock-Davis: www.babcockdavis.com/#sle.
4. Best Access Doors: www.bestaccessdoors.com/#sle.
5. Or Equal.
6. Substitutions: See Section 01 60 00 - 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. Material: Steel.
2. Style: Frame concealed by door panel(typical) and Recessed door panel for infill with wall/ceiling finish material at all exposed visible locations.
 - a. Gypsum Board Mounting Criteria: Use drywall bead type frame.
3. Door Style: Single thickness with rolled or turned in edges.
4. Frames: 16-gauge, 0.0598-inch minimum thickness.
5. Single Steel Sheet Door Panels: 16-gauge, 0.0625-inch minimum thickness.
6. Units in Fire-Rated Assemblies: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.
 - a. Provide products listed by ITS (DIR) or UL (FRD) as suitable for purpose indicated.
7. Steel Finish: Primed.
8. Primed and Factory Finish: Polyester powder coat; color as selected by Architect from manufacturer's standard colors.
9. Door/Panel Size: As indicated on the drawings.
10. 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. Handle: Handle operated cam latch.
 - d. Latch/Lock: Screw driver slot for quarter turn cam latch. For recessed door panel style only
 - e. Inside Latch Release: Mechanism that allows door/panel to be opened from inside.
 - f. Gasketing: Extruded neoprene, around perimeter of door panel.

PART 3 EXECUTION

3.1 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.

3.2 PREPARATION

- A. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.3 INSTALLATION

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

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

END OF SECTION

SECTION 08 42 29 - AUTOMATIC ENTRANCES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Sliding type packaged power-operated door assemblies.
- B. Controllers, actuators and safety devices.

1.2 RELATED REQUIREMENTS

- A. Section 26 05 83 - Wiring Connections.
- B. Section 28 13 00 - Security and Access Control: Connection to access control system; access control devices used as actuators.
- C. Section 28 46 00 - Fire Detection and Alarm: Connection to fire alarm system.

1.3 DEFINITIONS

- A. AAADM: American Association of Automatic Door Manufacturers.

1.4 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. BHMA A156.10 - Power Operated Pedestrian Doors; 2024.
- C. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.5 SUBMITTALS

- A. Products and materials specified in this Section are subject to the Build America, Buy America (BABA) requirements described in Division 01. Submit BABA Compliance Documentation demonstrating that products comply with HUD BABA requirements prior to procurement. Products not meeting BABA requirements shall not be incorporated into the Work.
- B. Shop Drawings:
 - 1. Indicate layout and dimensions; head, jamb, and sill conditions; elevations; components, anchorage, recesses, materials, and finishes, electrical characteristics and connection requirements.
 - 2. Identify installation tolerances required, assembly conditions, routing of service lines and conduit, and locations of operating components and boxes.
- C. Product Data: Include system components, sizes, features, and finishes.
- D. Maintenance Data: Include manufacturer's parts list and maintenance instructions for each type of hardware and operating component.

1.6 QUALITY ASSURANCE

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

1.7 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide two-year manufacturer warranty. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Sliding Automatic Entrance Door Assemblies:
 - 1. ASSA ABLOY Entrance Solutions; Besam SL500: www.besam-usa.com/#sle.
 - 2. NABCO Entrances Inc; GT 1175 Whisper Slider: www.nabcoentrances.com/#sle.
 - 3. Stanley Access Technologies; DuraFit Telescoping Automatic Doors: www.stanleyaccess.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 POWER OPERATED DOORS

- A. Power Operated Doors: Provide products that comply with NFPA 101 and requirements of authorities having jurisdiction; provide equipment selected for actual door weight and for light pedestrian traffic, unless otherwise indicated.
 - 1. Packaged Door Assemblies: Provide components by single manufacturer, factory-assembled, including doors, frames, operators, actuators, and safeties.
 - a. Finish exposed equipment components to match door and frame finish.
 - 2. Exterior and Vestibule Doors: Provide equipment suitable for operating temperature range of minus 20 to plus 140 degrees F ambient.

2.3 AUTOMATIC ENTRANCE DOOR ASSEMBLIES

- A. Comply with ADA Standards for egress requirements.
- B. Framing and Transom Members: Provide manufacturer's standard extruded aluminum framing, reinforced as required to support imposed loads.
 - 1. Nominal Sizes:
 - 2. Transoms: Provide flush glazed transom with framing that is integral with automatic entrance framing system.
- C. Door and Sidelight Construction: Heavy duty interlocked extruded aluminum tubular stile and rail sections, through-rod bolted construction with steel corner support at hinge stile of carrier-suspended swinging panels or mechanically fastened corners with welded reinforcing brackets to reduce sag in sliding or breakout mode.
 - 1. Door Thickness: 1-3/4 inch, nominal.
 - 2. Stile Design:
 - 3. Top Rail Height: 4 inch, nominal.
 - 4. Bottom Rail Height: 10 inch, nominal.
 - 5. Glazing Stops: Manufacturer's standard snap-on extruded aluminum square stops with preformed resilient glazing gaskets.
 - 6. Glazing Stop Width: Manufacturers standard.
 - 7. Glazing Thickness: 1/4 inch.

2.4 CONTROLLERS, ACTUATORS, AND SAFETIES

- A. Comply with BHMA A156.10 for actuator and safety types and zones.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work and dimensions are as indicated on shop drawings.
- B. Verify that electric power is available, at the correct location, and is of the correct characteristics.

3.2 INSTALLATION

- A. Install equipment in accordance with manufacturer's written instructions, except where more stringent requirements are specified.
- B. Provide for thermal expansion and contraction of door and frame units and live and dead loads that may be transmitted to operating equipment.
- C. Provide for dimensional distortion of components during operation.
- D. Coordinate installation of components with related and adjacent work; level and plumb.

3.3 ADJUSTING

- A. Adjust entrances for correct function and smooth operation, without binding or scraping and without excessive noise; lubricate operating hardware and other moving parts.

3.4 CLEANING

- A. Remove temporary protection; clean exposed surfaces.

3.5 CLOSEOUT ACTIVITIES

- A. Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.6 MAINTENANCE

- A. See Section 01 70 00 - Execution Requirements for additional requirements.
- B. Provide service and maintenance of operating equipment for one year from Date of Substantial Completion, at no extra charge to Owner.

END OF SECTION

SECTION 08 53 13 - VINYL WINDOWS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Vinyl-framed, factory-glazed windows.
- B. Operating hardware.
- C. Insect screens.

1.2 RELATED REQUIREMENTS

- A. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.

1.3 REFERENCE STANDARDS

- A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights; 2022, with Errata (2023).
- B. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights; 2023.

1.4 SUBMITTALS

- A. See Section 01 31 50 - Submittals
- B. Product Data: Provide component dimensions, anchors, fasteners, glass, and internal drainage.
- C. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related work, and installation requirements.
- D. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
 - 1. Evidence of AAMA Certification.
 - 2. Evidence of WDMA Certification.
 - 3. Evidence of CSA Certification.
 - 4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.
- E. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements in excess of those prescribed by specified grade.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with minimum 5 years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified, with minimum 5 years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect finished surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.

1.7 FIELD CONDITIONS

- A. Maintain this minimum temperature during and after installation of sealants.

1.8 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Correct defective work within a 5-year period after Date of Substantial Completion.
- C. Manufacturer Warranty: Provide 10-year manufacturer warranty for insulated glass units from seal failure, interpane dusting or misting, and replacement of same. Include coverage for degradation of vinyl color finish. Complete form in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Vinyl Windows:
 - 1. Andersen Windows: www.andersenwindows.com
 - 2. Jeld-Wen, Inc.: www.jeld-wen.com.
 - 3. Pella Corporation; _____: www.pellacommercial.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 DESCRIPTION

- A. Vinyl Windows: Factory-fabricated frame and sash members of extruded, hollow, ultraviolet-resistant, _____ polyvinyl chloride (PVC) with integral color; with factory-installed glazing, hardware, related flashings, anchorage and attachment devices.
 - 1. Configuration: As indicated on drawings.
 - 2. Color: Color as selected.
 - 3. Exterior Color: As selected by Architect from manufacturer's full line of colors.
 - 4. Size to fit openings with minimum clearance around perimeter of assembly providing necessary space for perimeter seals.
 - 5. System Internal Drainage: Drain to exterior side by means of weep drainage network any water entering joints, condensation within glazing channel, or other migrating moisture within system.
 - 6. Glazing Stops, Trim, Flashings, and Accessory Pieces: Formed of rigid PVC, fitting tightly into frame assembly.
 - 7. Mounting Flange: Integral to frame assembly, providing weather stop at entire perimeter of frame.
 - 8. Insect Screens: Tight fitting for operating sash location.

2.3 PERFORMANCE REQUIREMENTS

- A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:
 - 1. Performance Class (PC): CW.
 - 2. Performance Grade (PG): Equivalent to or greater than specified design pressure.
- B. Design Pressure: In accordance with applicable codes.
- C. Overall Thermal Transmittance (U-value): 0.18, maximum, including glazing, measured on window sizes required for this project.

2.4 COMPONENTS

- A. Glazing: Insulated double pane, tempered glass, clear, low-E coated, argon filled, with glass thicknesses as recommended by manufacturer for specified wind conditions.
- B. Frame Depth: Manufacturer's standard.
- C. Divided Lite Grid: Installed between panes of insulating glass, 5/8 inch wide flat metal bars, color to match frame and sash.
 - 1. Pattern: As indicated on drawings.

- D. Insect Screens: Aluminum, extruded or roll-formed frame with mitered and reinforced corners; apply screen mesh taut to frame; secure to window with hardware to allow easy removal.
 - 1. Hardware: Manufacturer's standard; quantity as required per screen.
 - 2. Screen Mesh: Vinyl-coated fiberglass, window manufacturer's 18 x 16 mesh.
 - 3. Frame Finish: Manufacturer's standard, color to match window frame and sash color.
- E. Accessories: Provide related flashings, anchorage and attachment devices as necessary for full assembly.
- F. Sealants for Setting Window Sill Pan Flashing: Provide butyl tape, non-hardening butyl, polyurethane, or silicone sealant; in compliance with ASTM E2112 installation practices.

2.5 HARDWARE

- A. Vertical Sliding Sash: Metal and nylon spiral friction slide cylinder, provide two for each sash and jamb.
- B. Sash lock: Lever handle and keeper with cam lock, provide at least one for each operating sash.
- C. Sill lock: Extended paddle latch.
- D. Window Opening Control Devices (WOCD):
 - 1. Hardware shall limit openings to only allow passage of 4 inch diameter rigid sphere or less, and are easily releasable to fully open without use of keys, tools, or special knowledge.
 - 2. Provide WOCDs on all windows that are installed more than 72" above finished exterior grade.
 - 3. Provide WOCDs on all windows located in the Memory Care Unit.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify wall openings and adjoining water-resistive barrier seal materials are ready to receive this work.

3.2 INSTALLATION

- A. Install window unit assemblies in accordance with manufacturers instructions and applicable building codes.
- B. Install windows in accordance with ASTM E2112.
- C. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities as necessary.
- D. Align window plumb and level, free of warp or twist, and maintain dimensional tolerances and alignment with adjacent work.
- E. Set sill members and sill flashing in continuous bead of sealant.
- F. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

3.3 ADJUSTING

- A. Adjust hardware for smooth operation and secure weathertight closure.

3.4 CLEANING

- A. Remove protective material from pre-finished surfaces.

- B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.

END OF SECTION

SECTION 08 71 00 - DOOR HARDWARE

PART 1 GENERAL

1.1 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. "Stile and Rail Wood Doors"
 - d. "Interior Aluminum Doors and Frames"
 - e. "Aluminum-Framed Entrances and Storefronts"
 - f. "Stainless Steel Doors and Frames"
 - g. "Special Function Doors"
 - h. "Entrances"
 - 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.

1.2 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

1.3 SUBMITTALS

- A. General:
 - 1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
 - 2. Prior to forwarding submittal:
 - 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. Products and materials specified in this Section are subject to the Build America, Buy America (BABA) requirements described in Division 01. Submit BABA Compliance Documentation demonstrating that products comply with HUD BABA requirements prior to procurement. Products not meeting BABA requirements shall not be incorporated into the Work.
 - 2. 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.
 - 3. 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.
 - 4. 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.
 - 5. 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.

6. 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:
 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.

1.4 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
 - 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.
- 1.5 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.

1.6 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.

1.7 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) 10 years
 - 2) Exit Devices
 - a) 10 years
 - 3) Closers
 - a) 10 years
 - b. Electrical Warranty
 - 1) Closers
 - a) 2 years

1.8 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.

PART 2 PRODUCTS

2.1 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 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.

2.2 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.

2.3 HINGES

- A. Manufacturers and Products:
 1. Scheduled Manufacturer and Product:
 - a. Ives 5BB series
 2. Acceptable Manufacturers and Products:
 - a. Hager BB1191/1279 series
 - b. McKinney TB series
- B. Requirements:
 1. Provide hinges conforming to ANSI/BHMA A156.1.
 2. Provide five knuckle, ball bearing hinges.
 3. 1-3/4 inch thick doors, up to and including 36 inches wide:
 - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches high
 - b. Interior: Standard weight, steel, 4-1/2 inches high
 4. 1-3/4 inch thick doors over 36 inches wide:
 - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches high
 - b. Interior: Heavy weight, steel, 5 inches high
 5. 2 inches or thicker doors:
 - a. Exterior: Heavy weight, bronze or stainless steel, 5 inches high
 - b. Interior: Heavy weight, steel, 5 inches 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 or less in height, and one additional hinge for each 30 inches 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. 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 at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.

2.4 CONTINUOUS HINGES

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Select
 - b. Roton

B. Requirements:

1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
5. On fire-rated doors, provide aluminum geared continuous hinges classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
6. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
7. Provide hinges 1 inch shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.5 FLUSH BOLTS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Burns
 - b. Trimco

B. Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch steel or brass rods at doors up to 90 inches in height. For doors over 90 inches in height increase top rods by 6 inches for each additional 6 inches of door height. Provide dust-proof strikes at each bottom flush bolt.

2.6 COORDINATORS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Burns
 - b. Trimco

B. Requirements:

1. Where pairs of doors are equipped with automatic flush bolts, an astragal, or other hardware that requires synchronized closing of the doors, provide bar-type coordinating device, surface applied to underside of stop at frame head.

2. Provide filler bar of correct length for unit to span entire width of opening, and appropriate brackets for parallel arm door closers, surface vertical rod exit device strikes, or other stop mounted hardware. Factory-prepared coordinators for vertical rod devices as specified.

2.7 CYLINDRICAL LOCKS – GRADE 1

- A. Manufacturers and Products:
 1. Scheduled Manufacturer and Product:
 - a. Schlage ND series
 2. Acceptable Manufacturers and Products:
 - a. No Substitute
- B. Requirements:
 1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3-hour fire doors.
 2. Indicators: Where specified, provide escutcheon with lock status indicator window on top of lockset rose:
 - a. Escutcheon height (including rose) 6.05 inches high by 3.68 inches wide.
 - b. Indicator window measuring a minimum 3.52-inch by .60 inch with 1.92 square-inches of front facing viewing area and 180-degree visibility with a total of .236 square-inches of total viewable area.
 - c. Provide snap-in serviceable window to prevent tampering. Lock must function if indicator is compromised.
 - d. Provide messages color-coded with full text and symbol, as scheduled, for easy visibility.
 - e. Unlocked and Unoccupied message will display on white background, and Locked and Occupied message will display on red background.
 3. Cylinders: Refer to "KEYING" article, herein.
 4. Provide locks with standard 2-3/4 inches backset, unless noted otherwise, with 1/2-inch latch throw. Provide proper latch throw for UL listing at pairs.
 5. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
 6. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
 7. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
 8. Provide electrified options as scheduled in the hardware sets.
 9. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.
 - a. Lever Design: ATH

2.8 CYLINDRICAL LOCKS – GRADE 2

- A. Manufacturers and Products:
 1. Scheduled Manufacturer and Product:
 - a. Schlage ALX series
 2. Acceptable Manufacturers and Products:
 - a. No Substitute
- B. Requirements
 1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 2, and UL Listed for 3-hour fire doors with a minimum cycle life of 1 million.
 2. Cylinders: Refer to "KEYING" article, herein.
 3. Provide locks with standard 2-3/4 inches backset, unless noted otherwise, with 1/2-inch latch throw. Provide 3/4" latch throw for UL listing at pairs.
 4. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
 5. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
 6. Provide a minimum of 5 points of lever engagement between the cassette spindle and lever shank to prevent lever sag.
 7. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
 8. Plug-n-Play – Provide modular lockset allowing lock functions to be created for 7 typical functions by inserting/installing parts into the exterior of a fully assembled chassis

9. Reconfigurable Chassis - Provide modular lockset that allows the function to be reconfigured by removing external components from the chassis
10. Lever Trim: Solid cast levers and wrought roses on both sides.
 - a. Lever Design: ATH

2.9 TUBULAR LOCKS – GRADE 2 AT UNITS

- A. Manufacturers and Products:
 1. Scheduled Manufacturer and Product:
 - a. Schlage F series
 2. Acceptable Manufacturers and Products:
 - a. No Substitute
- B. Requirements:
 1. Provide tubular locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 2, Grade 2 and ANSI/BHMA A156.39 Residential Grade AAA, and UL Listed for 3-hour fire doors.
 2. Cylinders: Refer to "KEYING" article, herein.
 3. Provide locks with standard 2-3/8 inches adjustable to 2-3/4 inches backset with 1/2-inch (0.51 inch) latch throw. Provide 2-3/4 inches backset, unless 2-3/8 inches is required by door or frame detail or noted otherwise.
 4. Provide locksets that fit standard 2-1/8 inches diameter bore without use of thru bolts.
 5. Door Thickness: Locksets adjustable to fit in 1-3/8 inches or 1-3/4 inches door thickness.
 6. Provide standard T-strikes unless extended lip strikes are necessary to protect trim.
 7. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.
 - a. Lever Design: JAZ

2.10 EXIT DEVICES

- A. Manufacturers and Products:
 1. Scheduled Manufacturer and Product:
 - a. Falcon 24/25 series
 2. Acceptable Manufacturers and Products:
 - a. Sargent 19-43-GL-80 series
 - b. Precision Apex series
- 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 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 flush end caps for exit devices.
 7. Provide exit devices with manufacturer's approved strikes.
 8. 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.
 9. 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.
 10. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
 11. Removable Mullions: 2 inches x 3 inches 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.
 12. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
 13. Provide electrified options as scheduled.
 14. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.

2.11 ELECTRIC STRIKES

- A. Manufacturers and Products:
 - 1. Scheduled Manufacturer and Product:
 - a. Von Duprin 6000 Series
 - 2. Acceptable Manufacturers and Products:
 - a. Folger Adam 300 Series
 - b. HES 1006 Series
- 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.

2.12 CYLINDERS

- A. Manufacturers and Products:
 - 1. Scheduled Manufacturer:
 - a. Falcon
 - 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. Open: cylinder with small format interchangeable core (SFIC) core with open keyway

2.13 KEYING

- A. Scheduled System:
 - 1. New factory registered system:
 - a. Provide a factory registered keying system, complying 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).
 - 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.

2.14 KEY CONTROL SYSTEM

- A. Manufacturers:
1. Scheduled Manufacturer:
 - a. Lund
 2. Acceptable Manufacturers:
 - a. Telkee
 - b. HPC
- B. Requirements:
1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.
 - a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
 - b. Provide hinged-panel type cabinet for wall mounting.

2.15 KEY LOCK BOX

- A. Manufacturers:
1. Scheduled Manufacturer:
 - a. Knox Company
 2. Acceptable Manufacturers:
 - a. No Substitute
- B. Requirements
1. Provide Knox Box 3200 Series recessed key lock box, or equal.
 2. Provide lock box meeting the requirements of UL 1037, UL 1610, UL 1332, and UL 437.
 3. Provide lock box capable of storing a maximum of 10 keys.
 4. Provide lock box with hinged door and weather-resistant door gasket.
 5. Provide recessed mounting kit for new concrete or masonry construction.

2.16 DOOR CLOSERS

- A. Manufacturers and Products:
1. Scheduled Manufacturer and Product:
 - a. Falcon SC70A series
 2. Acceptable Manufacturers and Products:
 - a. LCN 4050 series
 - b. Norton 7500 series
- B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with aluminum cylinder.
3. Closer Body: 1-1/2-inch 1.5 inch diameter with 5/8-inch (0.63 inch) diameter heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL 10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees Fahrenheit to -30 degrees Fahrenheit.
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.

2.17 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Falcon SC80A series
2. Acceptable Manufacturers and Products:
 - a. LCN 1450 series
 - b. Norton 8000 series

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 with aluminum cylinder.
3. Closer Body: 1-1/4-inch 1.26 inch diameter, with 5/8-inch (0.63 inch) diameter heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL 10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees Fahrenheit to -30 degrees Fahrenheit.
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.

2.18 ELECTROMECHANICAL CLOSER/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. LCN 4040XP SE
2. Acceptable Manufacturers:
 - a. Norton
 - b. Rixson

B. Requirements:

1. Provide single-point or multi-point hold-open electromechanical closer/holders as specified. Coordinate voltage requirements and provide transformer if necessary.
2. Provide closer/holders that function as full rack and pinion door closer when current is interrupted or continuous hold-open is not engaged.
3. Provide door closers with fully hydraulic, full rack and pinion action with high strength cylinder and full complement bearings at shaft.
4. Hydraulic Fluid: Fireproof, passing requirements of UL 10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees Fahrenheit to -30 degrees Fahrenheit.

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.

2.19 DOOR TRIM

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

2.20 PROTECTION PLATES

- A. Manufacturers:
 1. Scheduled Manufacturer:
 - a. Ives
 2. Acceptable Manufacturers:
 - a. Burns
 - b. Trimco
- B. Requirements:
 1. Provide protection plates with a minimum of 0.050 inch thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
 2. Sizes plates 2 inches less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch 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.

2.21 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

- A. Manufacturers:
 1. Scheduled Manufacturers:
 - a. Glynn-Johnson
 2. Acceptable Manufacturers:
 - a. Rixson
 - b. Sargent
- B. Requirements:
 1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.

2.22 DOOR STOPS AND HOLDERS

- A. Manufacturers:
 1. Scheduled Manufacturer:
 - a. Ives
 2. Acceptable Manufacturers:
 - a. Burns
 - b. Trimco
- 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.

2.23 SILENCERS

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

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

- A. Manufacturers:
- B. Scheduled Manufacturer:
1. Zero International
- C. Acceptable Manufacturers:
1. National Guard
 2. Reese
- D. Seals and Gasketing: Provide continuous gasketing on exterior openings, to the head and jambs, forming a continuous seal between the door and the frame. Provide smoke, light, or sound gasketing on interior doors where indicated.
1. Provide self-tapping fasteners for aluminum extruded gasketing being applied to hollow metal frames.
 - a. Provide non-corrosive fasteners for all exterior applications.
 - b. Provide security fasteners where indicated.
 2. Provide neoprene, EPDM, silicone, or nylon brush inserts as specified in hardware sets. Provide non brush inserts of solid or sponge cell, as specified in hardware sets. Vinyl inserts are not allowed except where specified in hardware sets.
- E. Smoke Labeled Gasketing: At all smoke labeled openings, provide smoke listed perimeter gasketing assemblies complying with NFPA 105 listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for smoke control ratings indicated based on testing according to UL 1784.
- F. Fire Listed Gasketing: Assemblies complying with NFPA 80 that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction for fire ratings indicated based on testing according to UL 10C.
1. Where frame-applied intumescent seals are required by the manufacturer, provide gaskets that comply with UL 10C Standard for Positive Pressure Fire Tests of Door Assemblies and UBC 7-2, Fire Tests of Door Assemblies.
- G. Sound-Rated Gasketing: Provide acoustic gasketing to meet Sound Transmission Class (STC) rating required.
- H. Meeting-Stile Gasketing: Provide meeting-stile gasketing that fastens to the meeting stiles forming a continuous seal when doors are closed.
- I. Door Sweeps or Shoes: Apply to the bottom of the door to close the gap between the door bottom and finished floor or saddle threshold.

1. Provide solid neoprene, EPDM, silicone, or nylon brush type of seal as specified in hardware sets. Vinyl inserts are not allowed except where specified in hardware sets.
- J. Automatic Door Bottoms:
 1. Provide closed cell sponge, bulb neoprene, or EPDM type of seal as specified in hardware sets.
 2. Door bottom to be mortised, semi mortised, or surface mount as with a minimum thickness as specified in hardware sets.
- K. Rain Drips:
 1. Provide overhead rain drips for out-swinging hollow metal doors that are not covered against 45 degree blowing rain. Aluminum extrusion to be a minimum of .088 inches thick and extend 2.50 inches from the face of the frame, in anodized finish to match door.
 2. Door sweeps or shoes with integral rain drip must meet ADA requirements
- L. Thresholds: Provide threshold units not less than 4 inches wide, formed to accommodate change in floor elevation where indicated, and fabricated to accommodate door hardware and fit door frames.
 1. Threshold extrusion to be a minimum thickness as specified in hardware sets.

2.25 MAGNETIC HOLDERS

- A. Manufacturers:
 1. Scheduled Manufacturer:
 - a. LCN
 2. Acceptable Manufacturers:
 - a. Rixson
 - b. Sargent
- B. Requirements:
 1. Provide wall or floor mounted electromagnetic door release as specified with minimum of 25 pounds of holding force. Coordinate projection of holder and armature with other hardware and wall conditions to ensure that door sits parallel to wall when fully open. Connect magnetic holders on fire-rated doors into the fire control panel for fail-safe operation.

2.26 DOOR VIEWERS

- A. Manufacturers:
 1. Scheduled Manufacturer:
 - a. Ives
 2. Acceptable Manufacturers:
 - a. Burns
 - b. Rockwood
- B. Provide appropriate door viewer for door type and rating with minimum of 180-degree view area.

2.27 LATCH PROTECTORS

- A. Manufacturers:
 1. Scheduled Manufacturer:
 - a. Ives
 2. Acceptable Manufacturers:
 - a. Burns
 - b. Trimco
- B. Provide stainless steel latch protectors of type required to function with specified lock.

2.28 COAT HOOKS

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

- a. Burns
- b. Rockwood

- B. Provide coat hooks as specified.

PART 3 EXECUTION

3.1 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.
- C. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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:
1. Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
 2. Aluminum thresholds to be cut-in, and scribed around mullions, frame members, and stops. Do not butt to thresholds. Provide a continuous surface across full width of opening from jamb to jamb.
 3. Where aluminum panic-type (rabbeted) thresholds with neoprene inserts are specified, undercut doors as required to properly mate with seal in threshold.
- 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:
1. Apply to head and jamb, forming seal between door and frame.
 2. Install gasketing in a manner eliminating need to cut any seal to install surface mounted hardware. Install compatible mounting bracket for surface mounted hardware unless minimum 1/4 inch thick solid aluminum seals are provided for mounting of surface applied hardware.
- S. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- T. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.
- 3.3 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.
- 3.4 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.

3.5 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:

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HARDWARE GROUP NO. 01

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 PER 08 71 00	652	IVE
1	EA	PASSAGE SET	ALX10 ATH BABA	626	SCH
1	EA	SURFACE CLOSER	SC81A DEL RW/PA	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR BOTTOM	360AA-Z49	AA	ZER

HARDWARE GROUP NO. 02

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 PER 08 71 00	652	IVE
1	EA	PASSAGE SET	ALX10 ATH BABA	626	SCH
1	EA	SURFACE CLOSER	SC81A DEL RW/PA	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 03

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 PER 08 71 00	652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S ATH OS- OCC BABA	626	SCH
1	EA	SURFACE CLOSER	SC81A DEL RW/PA	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	MOP PLATE	8400 4" X 1" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 04

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 PER 08 71 00	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ALX50BDC ATH BABA	626	SCH
1	EA	SFIC CORE	C606 SFIC	626	FAL
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	SC81A DEL RW/PA	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 05

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 PER 08 71 00	652	IVE
1	EA	CLASSROOM LOCK	ALX70BDC ATH BABA	626	SCH
1	EA	SFIC CORE	C606 SFIC	626	FAL
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 06

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 PER 08 71 00	652	IVE
1	EA	CLASSROOM LOCK	ALX70BDC ATH BABA	626	SCH
1	EA	SFIC CORE	C606 SFIC	626	FAL
1	EA	SURFACE CLOSER	SC81A DEL RW/PA	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 07

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 PER 08 71 00	652	IVE
1	EA	CLASSROOM LOCK	ALX70BDC ATH BABA	626	SCH
1	EA	SFIC CORE	C606 SFIC	626	FAL
1	EA	SURFACE CLOSER	SC81A DEL SS	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 08

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 PER 08 71 00	652	IVE
1	EA	AUTO FLUSH BOLT	FB31P/FB41P	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	CLASSROOM LOCK	ALX70BDC ATH BABA	626	SCH
1	EA	SFIC CORE	C606 SFIC	626	FAL
1	EA	COORDINATOR	COR X FL (MB AS REQ'D)	628	IVE
1	EA	OH STOP	100S	630	GLY

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	SURFACE CLOSER	SC81A DEL RW/PA	689	FAL
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
2	EA	OVERLAPPING ASTRAGAL	BY DOOR/FRAME MANUFACTURER		B/O

HARDWARE GROUP NO. 09

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 PER 08 71 00	652	IVE
2	EA	MANUAL FLUSH BOLT	FB358/FB458 (AS REQ'D)	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	CLASSROOM LOCK	ALX70BDC ATH BABA	626	SCH
1	EA	SFIC CORE	C606 SFIC	626	FAL
2	EA	OH STOP & HOLDER	100H	630	GLY
1	EA	OVERLAPPING ASTRAGAL	BY DOOR/FRAME MANUFACTURER		B/O
2	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 10

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 PER 08 71 00	652	IVE
1	EA	STOREROOM LOCK	ALX80BDC ATH BABA	626	SCH
1	EA	SFIC CORE	C606 SFIC	626	FAL
1	EA	SURFACE CLOSER	SC81A DEL RW/PA	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 11

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5 PER 08 71 00	652	IVE
1	EA	STOREROOM LOCK	ALX80BDC ATH BABA	626	SCH
1	EA	SFIC CORE	C606 SFIC	626	FAL
1	EA	SURFACE CLOSER	SC81A DEL RW/PA	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 12

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 PER 08 71 00	652	IVE
1	EA	STOREROOM LOCK	ALX80BDC ATH BABA	626	SCH
1	EA	SFIC CORE	C606 SFIC	626	FAL
1	EA	SURFACE CLOSER	SC81A DEL SS	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 13

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 PER 08 71 00	652	IVE
1	EA	STOREROOM LOCK	ALX80BDC ATH BABA	626	SCH
1	EA	SFIC CORE	C606 SFIC	626	FAL
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	SC81A DEL RW/PA	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 14

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	HINGE	5BB1 4.5 X 4.5 PER 08 71 00	652	IVE
1	EA	AUTO FLUSH BOLT	FB31P/FB41P	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	ALX80BDC ATH BABA	626	SCH
1	EA	SFIC CORE	C606 SFIC	626	FAL
1	EA	COORDINATOR	COR X FL (MB AS REQ'D)	628	IVE
2	EA	SURFACE CLOSER	SC81A DEL SS	689	FAL
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
2	EA	OVERLAPPING ASTRAGAL	BY DOOR/FRAME MANUFACTURER		B/O

HARDWARE GROUP NO. 15

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	LD-25-R-EO	626	FAL
1	EA	SFIC HOUSING	RIM/MORTISE AS REQ'D	626	SCH
1	EA	SFIC CORE	C606 SFIC	626	FAL
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	SC71A RW/PA	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	SET	GASKETING	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A-223	A	ZER
1	EA		DOOR POSITION SWITCH - WORK OF DIVISION 28		
1	EA	DOOR PROPPED ALARM	EAX-300W	GRY	DET

OPERATION: PROP OPEN ALARM: ALARM WILL SOUND IF DOOR IS PROPPED OPEN LONGER THAN THE SET TIME (ESTABLISHED BY OWNER) . ALARM CAN BE SILENCED OR RESET BY MECHANICAL KEY.

HARDWARE GROUP NO. 16

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	LD-25-R-EO	626	FAL
1	EA	SFIC HOUSING	RIM/MORTISE AS REQ'D	626	SCH
1	EA	SFIC CORE	C606 SFIC	626	FAL
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	SC71A RW/PA	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	SET	GASKETING	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A-223	A	ZER
1	EA		DOOR POSITION SWITCH - WORK OF DIVISION 28		
1	EA	DOOR PROPPED ALARM	EAX-300W	GRY	DET

OPERATION: PROP OPEN ALARM: ALARM WILL SOUND IF DOOR IS PROPPED OPEN LONGER THAN THE SET TIME (ESTABLISHED BY OWNER) . ALARM CAN BE SILENCED OR RESET BY MECHANICAL KEY.

HARDWARE GROUP NO. 17

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	HINGE	5BB1 4.5 X 4.5 PER 08 71 00	652	IVE
1	EA	FIRE EXIT HARDWARE	F-25-R-L-BE-AVA	626	FAL
1	EA	SURFACE CLOSER	SC81A DEL RW/PA	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 18

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224HD	628	IVE
1	EA	PANIC HARDWARE	LD-25-R-NL-OP	626	FAL
1	EA	SFIC HOUSING	RIM/MORTISE AS REQ'D	626	SCH
1	EA	SFIC RIM HOUSING	80-159 BRN	626	SCH
2	EA	SFIC CORE	C606 SFIC	626	FAL
1	EA	ELECTRIC STRIKE	6300 FSE 12/24 VAC/VDC	630	VON
1	EA	90 DEG OFFSET PULL	8190EZHD 12" O	630-316	IVE
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	SC71A RW/PA	689	FAL
1	EA	RAIN DRIP	142AA	AA	ZER
1	SET	GASKETING	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A-223	A	ZER
1	EA		CREDENTIAL READER - WORK OF DIVISION 28		
2	EA		DOOR POSITION SWITCH - WORK OF DIVISION 28		
1	EA	DOOR PROPPED ALARM	EAX-300W	GRY	DET
1	EA		REQUEST TO EXIT SWITCH - WORK OF DIVISION 28		
1			POWER SUPPLY - WORK OF DIVISION 28		

OPERATION: DOOR NORMALLY CLOSED AND LOCKED. PRESENTING VALID CREDENTIAL TO READER
MOMENTARILY RELEASES ELECTRIC STRIKE ALLOWING ENTRY. FREE EGRESS AT ALL TIMES.

PROP OPEN ALARM: ALARM WILL SOUND IF DOOR IS PROPPED OPEN LONGER THAN THE SET TIME
(ESTABLISHED BY OWNER) . ALARM CAN BE SILENCED OR RESET BY MECHANICAL KEY.

HARDWARE GROUP NO. 19

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	AUTO FLUSH BOLT	FB31P/FB41P	630	IVE
1	EA	DUST PROOF STRIKE	DP1	626	IVE
1	EA	FIRE EXIT HARDWARE	F-25-M-L-NL-AVA	626	FAL
1	EA	SFIC MORTISE HOUSING	80-102 BRN (BLOCKING RING AND CAM AS REQUIRED)	626	SCH
1	EA	SFIC HOUSING	RIM/MORTISE AS REQ'D	626	SCH
2	EA	SFIC CORE	C606 SFIC	626	FAL
1	EA	LOCK GUARD	LG10	630	IVE
1	EA	COORDINATOR	COR X FL (MB AS REQ'D)	628	IVE
2	EA	SURFACE CLOSER	SC71A SSHO	689	FAL
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	SET	GASKETING	429AA-S	AA	ZER
1	EA	OVERLAPPING ASTRAGAL	BY DOOR/FRAME MANUFACTURER		B/O
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A-223	A	ZER
2	EA		DOOR POSITION SWITCH - WORK OF DIVISION 28		
1	EA	DOOR PROPPED ALARM	EAX-300W	GRY	DET

OPERATION: PROP OPEN ALARM: ALARM WILL SOUND IF DOOR IS PROPPED OPEN LONGER THAN THE SET TIME (ESTABLISHED BY OWNER) . ALARM CAN BE SILENCED OR RESET BY MECHANICAL KEY.

HARDWARE GROUP NO. 20

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 PER 08 71 00	652	IVE
2	EA	FIRE EXIT HARDWARE	F-25-C-WDC-L- LBR-AVA-SNB	626	FAL
2	EA	SFIC MORTISE HOUSING	80-102 BRN (BLOCKING RING AND CAM AS REQUIRED)	626	SCH
2	EA	SFIC CORE	C606 SFIC	626	FAL
2	EA	OH STOP	100SE	630	GLY
2	EA	FIRE/LIFE CLOSER	4040SE 24V/120V AC/DC AS REQ	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
2	EA	MEETING STILE	8194AA	AA	ZER

ELECTRIFIED DOOR CLOSERS TO BE POWERED BY FIRE ALARM SYSTEM.

OPERATION: DOORS NORMALLY HELD OPEN BY ELECTRIFIED DOOR CLOSERS. TIE DOOR CLOSER HOLD OPENS INTO FIRE ALARM. UPON ACTIVATION OF FIRE ALARM OR POWER FAILURE CLOSER HOLD OPENS TO RELEASE ALLOWING DOOR TO CLOSE AND LATCH. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 21

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 PER 08 71 00	652	IVE
2	EA	FIRE EXIT HARDWARE	F-25-C-WDC- EO-LBR-SNB	626	FAL
2	EA	SURFACE CLOSER	SC71A RW/PA	689	FAL
4	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	MAGNET	SEM7800 SERIES AS REQ'D	689	LCN
1	EA	GASKETING	488SBK PSA	BK	ZER
2	EA	MEETING STILE	8194AA	AA	ZER

MAGNETIC HOLD-OPENS TO BE POWERED BY FIRE ALARM SYSTEM.

OPERATION: DOORS HELD OPEN ON MAGNETIC HOLD OPENS. UPON POWER LOSS OR FIRE ALARM
SIGNAL DOORS TO RELEASE FROM MAGNETIC HOLDERS, CLOSE AND LATCH.

HARDWARE GROUP NO. 22

PROVIDE EACH SL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
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ALL REQUIRED HARDWARE BY SLIDING DOOR MANUFACTURER

HARDWARE GROUP NO. MISC

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	KEY CABINET	1200 SERIES + 50% EXP.		LUN
1	EA	KNOX-BOX	3200 X MRK X ALUMINIZATION X BLACK		KNO

HARDWARE GROUP NO. U1

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 PER 08 71 00	646	IVE
1	EA	PASSAGE SET	ALX10 ATH BABA	619	SCH
1	EA	SGL CYL DEADBOLT	B60N 12-321 10-116	619	SCH
1	EA	SURFACE CLOSER	SC81A DEL RW/PA	689	FAL

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	DOOR STOP	060 OR 70 AS REQ'D	619	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	544A	A	ZER
1	EA	KNOCKER	02-3125 U700	619	IVE
1	EA	VIEWER	U700	619	IVE

HARDWARE GROUP NO. U2

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	1011 3.5 X 3.5	646	IVE
1	EA	PASSAGE SET	F10 JAZ	619	SCH
1	EA	DOOR STOP	060 OR 70 AS REQ'D	619	IVE

HARDWARE GROUP NO. U3

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	1011 3.5 X 3.5	646	IVE
1	EA	PRIVACY LOCK	F40 JAZ	619	SCH
1	EA	DOOR STOP	060 OR 70 AS REQ'D	619	IVE

HARDWARE GROUP NO. U4

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	1011 3.5 X 3.5 (IF NOT BY PREHUNG DOOR PROVIDER)	F619E	IVE
1	EA	STOREROOM LOCK	ALX80BDC ATH BABA	619	SCH
1	EA	SFIC CORE	C606 SFIC	626	FAL
1	EA	DOOR STOP	060 OR 70 AS REQ'D	F15	IVE

END OF SECTION

SECTION 08 88 13 - FIRE-RATED GLAZING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fire-rated glazing units.
- B. Glazing compounds.

1.2 RELATED REQUIREMENTS

- A. Section 08 11 13 - Hollow Metal Doors and Frames: Glazed lites in doors, borrowed lites, and transoms.

1.3 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 (Reapproved 2024).
- E. ASTM C1036 - Standard Specification for Flat Glass; 2025.
- F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2025.
- G. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2024, with Editorial Revision (2025).
- H. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.
- I. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2024.
- J. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2024.
- K. GANA (GM) - GANA Glazing Manual; 2022.
- L. GANA (SM) - GANA Sealant Manual; 2008.
- M. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- N. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (Reaffirmed 2016).
- O. ITS (DIR) - Directory of Listed Products; Current Edition.
- P. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.
- Q. NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies; 2022.
- R. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2023.
- S. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2023.

- T. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2020.
- U. NGA (LGRM) - Laminated Glazing Reference Manual; 2019.
- V. UL (DIR) - Online Certifications Directory; Current Edition.
- W. UL 9 - Standard for Fire Tests of Window Assemblies; Current Edition, Including All Revisions.
- X. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- Y. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- Z. UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

- A. See Section 01 31 50 - Submit for submittal procedures.
- B. Products and materials specified in this Section are subject to the Build America, Buy America (BABA) requirements described in Division 01. Submit BABA Compliance Documentation demonstrating that products comply with HUD BABA requirements prior to procurement. Products not meeting BABA requirements shall not be incorporated into the Work.
- C. Product Data on Glazing Unit Glazing Types: Provide structural, physical, and environmental characteristics, size limitations, special handling and installation requirements.
- D. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- E. Certificate: Certify that products of this section meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

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

1.6 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty for Insulating Glass Units: Provide 5-year manufacturer warranty coverage for seal failure, interpane dusting or misting, including providing products to replace failed units, and commencing on the Date of Substantial Completion. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Fire-Protection-Rated Glass:
 - 1. Manufacturers:
 - a. McGrory Glass, Inc; FireDefend Series ____: www.mcgrory.com/#sle.
 - b. SAFTIFIRST, a division of O'Keeffe's Inc; SuperClear 45-HS: www.safti.com/#sle.
 - c. Technical Glass Products: www.fireglass.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 PERFORMANCE REQUIREMENTS

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads and withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
 - 1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
 - 2. Provide glass edge support system sufficiently stiff to limit lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
 - 3. Glass thicknesses listed are minimum.
- B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain building enclosure vapor retarder and air barrier continuity.
- C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated, in accordance with manufacturer's published data as determined with the following procedures or test methods:
 - 1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW software.
 - 2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW software.
 - 3. Solar Optical Properties: Comply with NFRC 300 test method.

2.3 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: Comply with ASTM C1048.
 - 3. Kind FT - Fully Tempered Type: Comply with ASTM C1048.
 - 4. Impact-Resistant Safety Glass: Comply with ANSI Z97.1 - Class B, or 16 CFR 1201 - Category I criteria.
- B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
 - 1. Laminated Safety Glass: Comply with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.

2.4 GLAZING UNITS

- A. Fire-Resistance-Rated Glazing: Type, thickness, and configuration of glazing that contains flames, smoke, and blocks radiant heat, as required to achieve indicated fire rating period exceeding 45 minutes.
 - 1. Applications:
 - a. Glazing in fire-rated door assembly.
 - b. Glazing in fire-rated window assembly.
 - c. Glazing in sidelites, borrowed lites, and other glazed openings in fire-rated wall assemblies.
 - d. Other locations as indicated on drawings.
 - 2. Glass Type: Multi-laminate annealed glass with intumescent fire retardant interlayers.
 - 3. Provide products listed by ITS (DIR) or UL (DIR) and approved by authorities having jurisdiction.
 - 4. Safety Glazing Certification: 16 CFR 1201 Category II.
 - 5. Fire Rating Period: 60 minutes.
 - 6. Markings for Fire-Resistance-Rated Glazing Assemblies: Provide permanent markings on fire-resistance-rated glazing in compliance with ICC (IBC), local building code, and authorities having jurisdiction.
 - a. "W" - meets wall assembly criteria of ASTM E119 or UL 263 fire test standards.
 - b. "D" - meets fire door assembly criteria of NFPA 252, UL 10B, or UL 10C fire test standards.
 - c. "H" - meets fire door assembly hose stream test of NFPA 252, UL 10B, or UL 10C fire test standards.
 - d. "T" - meets temperature rise of not more than 450 degrees F above ambient at end of 30 minutes fire exposure in accordance with NFPA 252, UL 10B, or UL 10C fire test standards.
 - e. "XXX" - placeholder that represents fire rating period, in minutes.
- B. Fire-Protection-Rated Glazing: Type, thickness, and configuration of glazing that contains flame, smoke, and does not block radiant heat, as required to achieve indicated fire rating period of 90 minutes or less.

1. Applications:
 - a. Glazing in fire-resistance-rated door assembly.
 - b. Glazing in fire-resistance-rated window assembly.
 - c. Other locations as indicated on drawings.
2. Glass Type: Specialty tempered float glass.
3. Provide products listed by ITS (DIR) or UL (DIR) and approved by authorities having jurisdiction.
4. Safety Glazing Certification: 16 CFR 1201 Category II.
5. Fire-Rating Period: As indicated on drawings.
6. Markings for Fire-Protection-Rated Glazing Assemblies: Provide permanent markings on fire-protection-rated glazing in compliance with ICC (IBC), local building code, and authorities having jurisdiction
 - a. "D" - meets fire door assembly criteria of NFPA 252, UL 10B, or UL 10C fire test standards.
 - b. "OH" - meets fire window assembly criteria, including hose stream test of NFPA 257 or UL 9 fire test standards.
 - c. "H" - meets fire door assembly hose stream test of NFPA 252, UL 10B, or UL 10C fire tests standards.
 - d. "XXX" - placeholder that represents fire-rating period, in minutes.

2.5 GLAZING COMPOUNDS

- A. 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.

2.6 ACCESSORIES

- A. Setting Blocks: Aluminum silicate, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch 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. Continuous by one half the height of glazing stop by thickness to suit application, self adhesive on one face.
- C. Glazing Tape: Closed-cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to affect air barrier and vapor retarder seal.
- D. Glazing Gaskets: Flexible intumescent seals.

PART 3 EXECUTION

3.1 Examination

- 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.

3.2 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.

3.3 INSTALLATION - GENERAL

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

3.4 FIELD QUALITY CONTROL

- A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

3.5 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 four days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

END OF SECTION

SECTION 09 05 61 - COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
 - 1. Resilient tile and sheet.
 - 2. Carpet tile.
 - 3. Thin-set ceramic tile and stone tile.
- B. Preparation of new concrete floor slabs 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. Patching compound.
- F. Remedial floor coatings.

1.2 REFERENCE STANDARDS

- A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm [2 in.] Cube Specimens); 2024.
- B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters, and Gypsum Concrete; 2020.
- C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.

1.3 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.
- C. Adhesive Bond and Compatibility Test Report.

1.4 QUALITY ASSURANCE

- A. Contractor may perform adhesive and bond test with Contractor's own personnel or hire a testing agency.
- B. 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 Architect when specified ambient conditions have been achieved and when testing will start.

1.5 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.

1.6 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 or more than 85 degrees F.
- 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

2.1 MATERIALS

- A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
 - 1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
 - 2. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.
 - 3. Products:
 - a. ARDEX Engineered Cements; ARDEX Feather Finish: www.ardexamericas.com/#sle.
 - b. TEC Specialty Products LLC; TEC Feather Edge Skim Coat: www.tecspecialty.com/#sle.
 - c. USG Corporation; Durock Brand Advanced Skim Coat Floor Patch: www.usg.com/#sle.
- B. 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.
- C. Remedial Floor Coating, Two-Component: Single-layer coating resistant to water vapor transmission meeting flooring manufacturer's emission limits, resistant to alkalinity (pH) level found, and suitable for flooring adhesion without further treatment.
 - 1. Thickness: As required for application and in accordance with manufacturer's installation instructions.

PART 3 EXECUTION

3.1 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 and one test in each additional 1000 square feet, 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.

3.2 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 per 24 hours.
- F. Report: Report the information required by the test method.

3.3 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.

3.4 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.

3.5 ADHESIVE BOND AND COMPATIBILITY TESTING

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

3.6 APPLICATION OF REMEDIAL FLOOR COATING

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

3.7 PROTECTION

- A. Cover prepared floors with building paper or other durable covering.

END OF SECTION

SECTION 09 21 16 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Metal channel ceiling framing.
- C. Acoustic insulation.
- D. Gypsum wallboard.
- E. Joint treatment and accessories.
- F. Textured finish system.

1.2 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.
- B. Section 07 21 00 - Thermal Insulation: Acoustic insulation.
- C. Section 07 84 00 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.
- D. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.3 REFERENCE STANDARDS

- A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).
- B. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2017).
- C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.
- D. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2025.
- E. 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.
- F. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.
- G. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2024.
- H. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2024.
- I. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
- J. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.

1.4 SUBMITTALS

- A. Products and materials specified in this Section are subject to the Build America, Buy America (BABA) requirements described in Division 01. Submit BABA Compliance Documentation demonstrating that products comply with HUD BABA requirements prior to procurement. Products not meeting BABA requirements shall not be incorporated into the Work.
- B. Product Data: Provide data on gypsum board, glass mat faced gypsum board, accessories, and joint finishing system.

PART 2 PRODUCTS

2.1 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. USG Corporation: www.usg.com/#sle.
 - 7. Substitutions: See Section 01 60 00 - 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 and ceilings, unless otherwise indicated.
 - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
 - 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. Thickness:
 - a. Vertical Surfaces: 5/8 inch.
 - b. Ceilings: 5/8 inch.
 - c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
- C. Backing Board For Wet Areas: One of the following products:
 - 1. Application: Surfaces behind tile in wet areas including tub and shower surrounds and shower ceilings.
 - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - 3. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
 - a. Fire-Resistance-Rated Type: Type X core, thickness 5/8 inch.
 - b. Products:
 - 1) CertainTeed Corporation; 5/8" GlasRoc Tile Backer Type X: www.certainteed.com/#sle.
 - 2) Georgia-Pacific Gypsum; DensShield Tile Backer: www.gpgypsum.com/#sle.
 - 3) Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond eXP Fire-Shield Tile Backer: www.goldbondbuilding.com/#sle.
 - 4) USG Corporation; Durock Brand Glass-Mat Tile Backerboard 5/8 in. (15.9 mm): www.usg.com/#sle.
- 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. Type X Thickness: 5/8 inch.
 - 4. Edges: Tapered.
 - 5. Products:

- a. American Gypsum Company; M-Bloc Type X: www.americangypsum.com/#sle.
 - b. Georgia-Pacific Gypsum; ToughRock Mold-Guard Gypsum Board: www.gpgypsum.com/#sle.
 - c. Georgia-Pacific Gypsum; DensArmor Plus: www.gpgypsum.com/#sle.
 - d. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond XP Fire-Shield Gypsum Board: www.goldbondbuilding.com/#sle.
- E. Exterior Soffit Board: Exterior gypsum soffit board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings and soffits in protected exterior areas, 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.
 3. Types: Type X and Type C, in locations indicated.
 4. Type X Thickness: 5/8 inch.
 5. Type C Thickness: 5/8 inch.
 6. Edges: Tapered.
 7. Products:
 - a. American Gypsum Company; Exterior Soffit Gypsum Wallboard Type X: www.americangypsum.com/#sle.
 - b. CertainTeed Corporation; 5/8" Soffitboard Type C: www.certainteed.com/#sle.
 - c. Georgia-Pacific Gypsum; ToughRock Fireguard C Soffit Board: www.gpgypsum.com/#sle.
- F. Shaftwall and Coreboard: Type X; 1 inch thick by 24 inches wide, beveled long edges, ends square cut.

2.2 GYPSUM BOARD ACCESSORIES

- A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced.
1. Surface Burning Characteristics: Provide assemblies with Class I rating, when tested in accordance with ASTM E84.
 2. Thickness: Full thickness of cavity, unless otherwise indicated.
 3. Products:
 - a. CertainTeed Corporation; CertaPro AcoustaTherm Batts
 - b. Johns Manville Building Insulation Div.; Sound Control Batts
 - c. Knauf Fiber Glass; QuietTherm
 - d. Owens Corning; Sound Attenuation Batts
- B. Acoustic Insulation: ASTM C665; mineral fiber blanket, friction fit type, unfaced.
1. Surface Burning Characteristics: Provide assemblies with Class I rating, when tested in accordance with ASTM E84.
 2. Thickness: Full thickness of cavity, unless otherwise indicated.
 3. Products:
 - a. Roxul
 - b. Fibrex Insulations, Inc.
 - c. Rock Wool Manufacturing Co. Thermafiber LLC
- C. Fire-Resistance Rated and Acoustical Putty Pads: UL1479; moldable intumescent compound sheets.
1. Products:
 - a. Grace Construction Products; Flamesafe FSP 1077 Putty Pads
 - b. Knauf Drywall; Putty Pads
 - c. Specified Technologies, Inc; Series SSP Putty Pads
 - d. Tremco; TREMstop Electrical Box Insert
 - e. 3M; Fire Barrier Moldable Putty+Pads
- D. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
- E. 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 thick gypsum wallboard.

- 3. Expansion Joints:
 - a. Type: V-shaped metal with factory-installed protective tape.
- F. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
 - 1. Paper Tape: 2 inch wide, creased paper tape for joints and corners.
 - 2. Joint Compound: Drying type, vinyl-based, ready-mixed.
- G. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.
- H. Adhesive for Attachment to Wood, ASTM C557 and Metal:

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 SHAFT WALL INSTALLATION

- A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.
 - 1. Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 24 inches on center.
- B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.

3.3 FRAMING INSTALLATION

- A. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
 - 1. Level ceiling system to a tolerance of 1/1200.
 - 2. Laterally brace entire suspension system.
 - 3. Install bracing as required at exterior locations to resist wind uplift.
- B. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
- C. Blocking: Install wood blocking for support of:
 - 1. Wall-mounted cabinets.
 - 2. Plumbing fixtures.
 - 3. Toilet partitions.
 - 4. Toilet accessories.
 - 5. Wall-mounted door hardware.

3.4 ACOUSTIC ACCESSORIES INSTALLATION

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

3.5 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. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- C. Exterior Soffits: Install exterior soffit board perpendicular to framing, with staggered end joints over framing members or other solid backing.

3.6 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 apart on walls and ceilings over 50 feet long.
 - 2. At exterior soffits, not more than 30 feet apart in both directions.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.7 JOINT TREATMENT

- A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.
- B. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.
- C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
 - 2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 - 3. Level 3: Walls to receive textured wall finish.
 - 4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 - 5. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
- E. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.8 TOLERANCES

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

END OF SECTION

SECTION 09 30 00 - TILING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Tile for floor applications.
- B. Ceramic accessories.
- C. Ceramic trim.

1.2 RELATED REQUIREMENTS

- A. Section 09 05 61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.
- B. Section 09 21 16 - Gypsum Board Assemblies: Tile backer board.

1.3 REFERENCE STANDARDS

- A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2024.
- B. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2019.
- C. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2014 (Reaffirmed 2024).
- D. ANSI A326.3 - American National Standard Test Method for Measuring Dynamic Coefficient of Friction of Hard Surface Flooring Materials; 2021.
- E. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2025.
- F. TCNA (HB-GP) - Handbook for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs Installation; 2023.

1.4 SUBMITTALS

- A. See Section 01 31 50 - Submittals for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

1.5 MOCK-UPS

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Construct tile mock-up incorporating components specified for location.
 - 1. Locate where directed by Architect.
 - 2. Mock-up may remain as part of work.

1.6 FIELD CONDITIONS

- A. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Tile:
 - 1. Dal-Tile Corporation; As indicated on the drawings: www.daltile.com/#sle.
- B. Setting Materials:
 - 1. LATICRETE International, Inc: www.laticrete.com/#sle.
 - 2. Mapei Corporation: www.mapei.com/#sle.
 - 3. Source Limitations: Furnish products produced by single manufacturer and obtained from single supplier.
- C. Grout:
 - 1. LATICRETE International, Inc; As indicated on the drawings: www.laticrete.com/#sle.
 - 2. Mapei Corporation; As indicated on the drawings: www.mapei.com/#sle.
 - 3. Source Limitations: Furnish products produced by single manufacturer and obtained from single supplier.

2.2 Performance Requirements

- A. Floor Tile: Provide tile for flooring applications with minimum wet Dynamic Coefficient of Friction (DCOF) of 0.42 when tested in accordance with ANSI A326.3.

2.3 TRIM AND ACCESSORIES

- A. Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.
 - 1. Manufacturers: Same as for tile.

2.4 SETTING MATERIALS

- A. Provide setting and grout materials from same manufacturer.

2.5 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 where indicated on drawings and where no other type of grout is indicated.
 - 2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
 - 3. Color: As indicated on drawings.

2.6 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 gap, minimum.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive tile.
- B. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

- 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.

3.2 Preparation

- A. Vacuum clean surfaces and damp clean.
- B. Seal substrate surface cracks with filler.

3.3 INSTALLATION - GENERAL

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

3.4 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, on ground, with standard grout, unless otherwise indicated on drawings.
 - 1. Where crack isolation membrane is indicated on drawings, install in accordance with TCNA (HB) Method F125-Partial, with latex-Portland cement grout.

3.5 CLEANING

- A. Clean tile and grout surfaces.

3.6 PROTECTION

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

END OF SECTION

SECTION 09 51 00 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

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

1.2 REFERENCE STANDARDS

- A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- 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.

1.3 ADMINISTRATIVE REQUIREMENTS

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

1.4 SUBMITTALS

- A. See Section 01 31 50 - Submittals for submittal procedures.
- B. Products and materials specified in this Section are subject to the Build America, Buy America (BABA) requirements described in Division 01. Submit BABA Compliance Documentation demonstrating that products comply with HUD BABA requirements prior to procurement. Products not meeting BABA requirements shall not be incorporated into the Work.
- C. Product Data: Provide data on suspension system components and acoustical units.

1.5 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acoustic Tiles/Panels:
 - 1. Armstrong World Industries, Inc; ____: www.armstrongceilings.com/#sle.
 - 2. Acoustic Ceiling Products, Inc; ____: www.acpideas.com/#sle.
 - 3. Acoustics First Corporation; ____: www.acousticsfirst.com/#sle.
 - 4. Ceilings4U; ____: www.ceilings4u.com/#sle.
 - 5. Certaineed Architectural; ____: www.certainteed.com/ceilings-and-walls/#sle.
 - 6. Kinetics Noise Control, Inc; ____: www.kineticsnoise.com/#sle.
 - 7. USG Corporation; ____: www.usg.com/#sle.
- B. Suspension Systems:
 - 1. Same as for acoustical units.

2.2 ACOUSTICAL UNITS

- A. Acoustical Units - General: ASTM E1264, Class A.
- B. Acoustical Panels, Type ACT -1: Painted mineral fiber, with the following characteristics:
 - 1. Classification: ASTM E1264 Type A.
 - 2. Size: 24 by 24 inches.
 - 3. Thickness: 3/4 inch.
 - 4. Panel Edge: Square.
 - 5. Tile Edge: Beveled.
 - a. Joint: Kerfed and rabbeted.
 - 6. Color: White.
- C. _____
- D. ASTM E1264 Type A, Form A3 - Mineral fiber with scrubbable finish, typical in commercial kitchen/food prep areas.
- E. _____
- F. _____
- G. ASTM E1264 Type A, Form A4 - Mineral base with plastic or aluminum faced overlay; cleanroom classified option.
- H. _____
- I. _____
- J. ASTM E1264 Types C and D - Metal-faced acoustical panels (Type C) and planks (Type D).
- K. _____
- L. _____
- M. ASTM E1264 Type F - Wood with a mineral or glass fiber backing, Forms F1 (perforated) and F2 (non-perforated).
- N. _____
- O. _____
- P. ASTM E1264 Type G - Gypsum, Forms G1 (perforated) and G2 (non-perforated).
- Q. _____
- R. _____
- S. ASTM E1264 Type J - Melamine foam tiles, planks, and panels.
- T. _____

2.3 Suspension Systems

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold-down clips, stabilizer bars, clips, and splices as required.
 - 1. Materials:
 - a. Aluminum Grid: Aluminum sheet, ASTM B209/B209M.
- B. Exposed Suspension System: Aluminum grid and cap.
 - 1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
 - 2. Profile: Tee; 15/16 inch face width.
 - 3. Finish: Baked enamel.

2.4 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 galvanized steel wire.
- C. Perimeter Moldings: Same metal and finish as grid.
 - 1. Size: As required for installation conditions.
 - 2. Angle Molding: L-shaped, for mounting at same elevation as face of grid.
- D. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 Preparation

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

3.3 INSTALLATION - SUSPENSION SYSTEM

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

3.4 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.

3.5 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.6 CLEANING

A. Clean surfaces.

B. Replace damaged or abraded components.

END OF SECTION

SECTION 09 54 23 - LINEAR METAL CEILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Linear metal ceilings.
- B. Suspended metal support system and perimeter trim.

1.2 REFERENCE STANDARDS

- A. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019 (Reapproved 2025).
- B. 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.
- C. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

1.3 DESIGN REQUIREMENTS

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate work of this section with installation of mechanical and electrical components and with other construction activities affected by work of this section.

1.5 SUBMITTALS

- A. See Section 01 31 50 - Submittals for submittal procedures.
- B. Samples: Submit two samples ____ by ____ inch illustrating color and finish of components exposed to view.

1.6 MOCK-UPS

- A. Construct _____ mock-up, ____ feet long by ____ feet wide; include suspension system, panels, closures in mock-up.
- B. Locate mock-up where directed.
- C. Mock-up may remain as part of the work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Linear Metal Ceilings:
 - 1. As indicated on drawings
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 LINEAR METAL CEILINGs

- A. Linear Metal Ceiling System: Panels, suspension members, trim, and accessories as required to provide a complete system.
- B. Performance Requirements:
 - 1. Design to support imposed loads of indicated items without eccentric loading of supports.
 - 2. Design for maximum deflection of 1/360 of span.

2.3 COMPONENTS

- A. Linear Metal Panels:
 - 1. Classification: ASTM E1264, Class A, Type D, Form D2, non-perforated, aluminum formed sheet.
 - 2. Type: Linear panel with reveals; snap-in installation.
 - a. Size and Configuration: As indicated on drawings.
 - b. Panel Profile: Box shaped.
- B. Edge Molding, Expansion Joints, and Splices: Same material, thickness, and finish as linear panels.
- C. End Caps: Formed metal; same color and finish as sight-exposed surfaces of linear panels.
- D. Brackets: L-shaped, size recommended by ceiling manufacturer for specified application.
- E. Suspension Members: Formed steel sections, with integral attachment points; galvanized finish; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- F. Suspension Wire: Steel, annealed, galvanized finish, 9 gauge, 0.1144 inch diameter.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. Suspension Components:
 - 1. Install after above-ceiling work is complete in accordance with manufacturer's instructions, ASTM C636/C636M, and ASTM E580/E580M.
 - 2. Hang carrying members independent of walls, columns, ducts, light fixtures, pipe, and conduit; where carrying members are spliced, avoid visible displacement of face panels with adjacent panels.
 - 3. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest adjacent hangers to span the required distance.
- B. Linear Metal Ceiling:
 - 1. Install linear panels, baffles, and other system components in accordance with manufacturer's instructions.

3.3 TOLERANCES

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

3.4 CLEANING

- A. Clean surfaces.
- B. Replace damaged or abraded components.

END OF SECTION

SECTION 09 65 00 - RESILIENT FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

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

1.2 RELATED REQUIREMENTS

- A. Section 09 05 61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.3 REFERENCE STANDARDS

- A. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021 (Reapproved 2025).

1.4 SUBMITTALS

- A. See Section 01 30 00 - 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, 6 by 9 inch in size illustrating color and pattern for each resilient flooring product specified.
- E. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

1.5 QUALITY ASSURANCE

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

1.6 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 and 90 degrees F.

1.7 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 to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.1 TILE FLOORING

- A. As indicated on drawings

2.2 RESILIENT BASE

- A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; style as scheduled.
 - 1. Manufacturers:
 - a. As indicated on drawings.
 - 2. Height: As indicated on drawings
 - 3. Thickness: 0.125 inch.
 - 4. Finish: Satin.
 - 5. Length: Roll.
 - 6. Color: As indicated on drawings.
 - 7. Accessories: Premolded external corners and internal corners.

2.3 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
- C. Adhesive for Vinyl and Rubber Flooring:
- D. Moldings, Transition and Edge Strips: Same material as flooring.
- E. Sound Control Underlayment: Non-woven fabric composed of PET/Nylon polymer fibers.
 - 1. Thickness: 1/8 inch, nominal.

PART 3 EXECUTION

3.1 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. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
 - 1. Conduct tests by an independent testing agency acceptable to Owner.
 - 2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
- C. Verify that required floor-mounted utilities are in correct location.

3.2 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.

3.3 Installation - General

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Adhesive-Applied Installation:
 - 1. Place copper grounding strip in conductive adhesive and apply additional adhesive to top side of strip before installing static control flooring. Allow strip to extend beyond flooring in accordance with static control flooring manufacturer's instructions. Refer to Section 26 05 26 for grounding and bonding to building grounding system.

2. Fit joints and butt seams tightly.
 3. Set flooring in place, press with heavy roller to attain full adhesion.
 - D. Loose-Laid Installation: Set flooring in place in accordance with manufacturer's instructions.
 - E. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
 - F. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
 1. Resilient Strips: Attach to substrate using adhesive.
 - G. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- 3.4 Installation - Sound Control Underlayment
- A. Install in accordance with underlayment manufacturer's instructions.
- 3.5 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 loose-laid tile, fit interlocking edges tightly.
- 3.6 Installation - Resilient Base
- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
 - B. Install base on solid backing. Bond tightly to wall and floor surfaces.
- 3.7 CLEANING
- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
 - B. Clean in accordance with manufacturer's written instructions.
- 3.8 PROTECTION
- A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 09 68 13 - TILE CARPETING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Carpet tile, fully adhered.

1.2 RELATED REQUIREMENTS

- A. Section 09 05 61 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

1.3 SUBMITTALS

- A. See Section 01 31 50 - Submittals, 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. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- E. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- F. Operation and 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 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.5 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Tile Carpeting:
 - 1. As indicated on drawings

2.2 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.
- B. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

PART 3 EXECUTION

3.1 EXAMINATION

- A. 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 carpet tile.
- B. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
 - 1. Test in accordance with Section 09 05 61.
 - 2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.2 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. Vacuum clean substrate.

3.3 INSTALLATION

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions and CRI 104 (Commercial).
- C. Blend carpet from different cartons to ensure minimal variation in color match.
- D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.
- F. Fully adhere carpet tile to substrate.
- G. Trim carpet tile neatly at walls and around interruptions.
- H. Complete installation of edge strips, concealing exposed edges.

3.4 CLEANING

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

END OF SECTION

SECTION 09 91 13 - EXTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
- 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, and operating parts of equipment.
 - 5. Non-metallic roofing and flashing.
 - 6. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, zinc, and lead.
 - 7. Floors, unless specifically indicated.
 - 8. Glass.
 - 9. Concealed pipes, ducts, and conduits.

1.2 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications: Shop-primed items.
- B. Section 09 91 23 - Interior Painting.

1.3 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.
- B. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.
- C. Gloss Level 2: Flat refers to a lusterless or matte finish with a gloss range below 15 at 85 degrees, according to ASTM D 523.
- D. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- E. Gloss Level 4: Eggshell refers to low-sheen finish with a gloss range between 20 and 35 at 85 degrees, according to ASTM D 523.
- F. Gloss Level 5: Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 at 60 degrees, according to ASTM D 523.
- G. Gloss Level 6: Full gloss refers to high-sheen finish with a gloss range more than 70 at 60 degrees, according to ASTM D 523.
- H. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 REFERENCE STANDARDS

- A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2024.
- B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020 (Reapproved 2025).

- C. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.
- D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- E. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- F. SSPC-SP 2 - Hand Tool Cleaning; 2024.
- G. SSPC-SP 3 - Power Tool Cleaning; 2024.
- H. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.
- I. SSPC-SP 13/NACE No.6 - Surface Preparation of Concrete; 2018.

1.5 SUBMITTALS

- A. See Section 01 30 00 - 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(s) product is to be used in; include description of each system.
- C. Samples: Submit one paper "draw down" sample, 8-1/2 by 11 inches in size, for each finishing product and color specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
 - 2. Where sheen is not specified, submit each color in each sheen available.
 - 3. Step coats on Samples to show each coat required for system.
 - 4. Label each coat of each Sample.
 - 5. Label each Sample for location and application area.
- 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.
 - 2. Extra Paint and Finish Materials: 5 percent but not less than 1 gallon of each color; from the same product run, store where directed.
 - 3. Label each container with color in addition to the manufacturer's label.

1.6 MOCK-UPS

- A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.
- B. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - 2. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
 - a. Other Items: Architect will designate items or areas required.
 - 3. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.8 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer, or to damp or wet surfaces.
- D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 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. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
 - 1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
 - 2. 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.
 - 3. 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.
 - 4. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 - 5. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 6. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.
- B. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- 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.

2.3 PAINT SYSTEMS - EXTERIOR

- A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including brick, fiber cement siding, primed wood, and primed metal.
1. Two top coats and one coat primer.
 2. Top Coat(s): Exterior Latex; MPI #10, 11, 15, 119, or 214.
 - a. Products:
 - 1) Sherwin-Williams A-100 Exterior Latex Flat.
 3. Top Coat Sheen:
 - a. Flat: MPI gloss level 1; use this sheen for overhead surfaces.
 - b. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
 4. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Paint E-OP-FL - Concrete Floors to be Painted.
1. Two top coats and one coat primer.
 2. Top Coat(s): Latex Floor Paint, Low Gloss; MPI #60.
 - a. Products:
 - 1) Pittsburgh Paints Floor and Porch Enamel 100% Acrylic Latex, 3-510XI Series, Satin.
 - 2) S-W Amorseal Tread-Plex.
 3. Primer: As recommended by top coat manufacturer for specific substrate.

2.4 ACCESSORY MATERIALS

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

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin application of paints 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 affect proper application.
- D. Test shop-applied primer for compatibility with subsequent cover materials.
- E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Exterior Plaster and Stucco: 12 percent.
 2. Fiber Cement Siding: 12 percent.
 3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
 4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.
 5. Concrete Floors and Traffic Surfaces: 8 percent.

3.2 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 surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Concrete:
 - 1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 - 2. Prepare surface as recommended by top coat manufacturer and in accordance with SSPC-SP 13/NACE No.6.
- G. Masonry:
 - 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 - 2. Prepare surface as recommended by top coat manufacturer.
- H. Fiber Cement Siding: Remove dirt, dust and other foreign matter with a stiff fiber brush. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
- I. Exterior Gypsum Board: Fill minor defects with exterior filler compound. Spot prime defects after repair.
- J. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- K. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
 - 2. Prepare surface according to SSPC-SP 3.
- L. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
 - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3. Protect from corrosion until coated.
- M. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.
- N. Previously Coated Surfaces: If in sound condition, clean the surface of foreign material. Dull smooth, hard or glossy coatings and surfaces abrading surfaces. Apply a test area, allowing paint to dry one week before testing adhesion. If adhesion is poor, or if paint product attacks previous finish, remove previous coating. If paint is peeling or badly weathered, clean surface to sound substrate and treat according to requirements for new substrates.

3.3 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- C. Application Procedure: Spray, back roll, plus two finish coats.

- D. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
 - E. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
 - F. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.
 - G. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - H. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
 - I. Application Procedure: Spray, back roll, plus two finish coats.
 - J. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
 - K. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
 - L. Apply paints and finishes to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
 - M. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
 - N. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
 - O. Apply each coat to uniform appearance.
 - P. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.
 - Q. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
 - R. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.
 - S. Paint all exposed wall and roof penetrations and other miscellaneous unfinished materials that are adjacent to "finished" wall or roof materials including, but not limited to, exhaust wall caps, PVC vent pipes, exposed ductwork, window and door steel lintels, etc. Coordinate with MEP drawings.
- 3.4 CLEANING
- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
 - B. After completing paint and finish application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- 3.5 PROTECTION
- A. Protect finishes until completion of project.

- B. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- C. Touch-up damaged finishes after Substantial Completion.

3.6 SCHEDULE - MPI SYSTEMS

- A. Substrate: Concrete, Exterior .
 - 1. FirstPrimer: Primer, Alkali Resistant, Water Based; MPI # 3.
 - 2. Second Primer: Primer, Alkali Resistant, Water Based; MPI # 3.
 - 3. Intermediate Coat: Latex, Exterior, Low Sheen; MPI # 15.
 - 4. Top Coat: Latex, Exterior, Low Sheen; MPI # 15.
- B. Substrate: Cementitious Siding, Exterior .
 - 1. MPI System: EXT 3.3A - G3/4.
 - a. Primer: Factory Primed.
 - b. Intermediate Coat: Latex, Exterior, Low Sheen; MPI # 15.
 - c. Top Coat: Latex, Exterior, Low Sheen; MPI # 15.
- C. Substrate: CMU, Exterior .
 - 1. MPI System: EXT 4.2A - G5.
 - a. Primer: Block Filler, Latex, Interior/Exterior; MPI # 4.
 - b. Intermediate Coat: Latex, Exterior, Semi-Gloss; MPI # 11.
 - c. Top Coat: Latex, Exterior, Semi-Gloss; MPI # 11.
 - 2. MPI System: 4.2L - G5.
 - a. Primer: Primer, Alkali Resistant, Water Based; MPI # 3.
 - b. Intermediate Coat: Latex, Exterior, Semi-Gloss; MPI # 11.
 - c. Top Coat: Latex, Exterior, Semi-Gloss; MPI # 11.
- D. Substrate: Concrete Horizontal Surfaces, Exterior .
 - 1. MPI System: EXT 3.2A - G2/3.
 - a. Primer: Floor Paint, Latex, Low Gloss; MPI # 60.
 - b. Intermediate Coat: Floor Paint, Latex, Low Gloss; MPI # 60.
 - c. Top Coat: Floor Paint, Latex, Low Gloss; MPI # 60.
- E. Substrate: Steel, Exterior .
 - 1. MPI System: EXT 5.1C - 5G.
 - a. Primer: Primer, Alkyd, Anti-Corrosive for Metal; MPI # 79.
 - b. Intermediate Coat: Light Industrial Coating, Exterior, Water Based, Semi-Gloss; MPI # 163.
 - c. Top Coat: Light Industrial Coating, Exterior, Water Based, Semi-Gloss; MPI # 163.
- F. Substrate: Galvanized-Metal, Exterior .
 - 1. MPI System: EXT 5.3J - 5G.
 - a. Primer: Primer, Galvanized, Water Based; MPI # 134.
 - b. Intermediate Coat: Light Industrial Coating, Exterior, Water Based, Semi-Gloss; MPI # 163.
 - c. Top Coat: Light Industrial Coating, Exterior, Water Based, Semi-Gloss; MPI # 163.
- G. Substrate: Wood (Trim, Doors, Windows, Wood Board Siding and Fences), Exterior .
 - 1. MPI System: EXT 6.3L - G5.
 - a. Primer: Primer, Latex for Exterior Wood; MPI # 6.
 - b. Intermediate Coat: Latex, Exterior, Semi-Gloss; MPI # 11.
 - c. Top Coat: Latex, Exterior, Semi-Gloss; MPI # 11.
- H. Substrate: Portland Cement Plaster, Exterior .
 - 1. MPI System: EXT 9.1A - G3/4.
 - a. Primer: Primer, Alkali Resistant, Water Based; MPI # 3.
 - b. Intermediate Coat: Latex, Exterior, Low Sheen; MPI # 15.
 - c. Top Coat: Latex, Exterior, Low Sheen; MPI # 15.

- I. Substrate: Plastic, Exterior .
 - 1. Paint all exposed PVC vent pipes where penetrating shingle and or metal roofs. See Mechanical drawings for locations. Color to match roofing material (coordinate w/ architect).
 - 2. MPI System: EXT 6.8A - G3/4.
 - a. Primer: Primer, Bonding, Water Based; MPI # 17.
 - b. Intermediate Coat: Latex, Exterior, Low Sheen; MPI # 15.
 - c. Top Coat: Latex, Exterior, Low Sheen; MPI # 15.

END OF SECTION

SECTION 09 91 23 - INTERIOR PAINTING

PART 1 GENERAL

1.1 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. Prime surfaces to receive wall coverings.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
 - 6. Floors, unless specifically indicated.
 - 7. Ceramic and other tiles.
 - 8. Glass.
 - 9. Acoustical materials, unless specifically indicated.
 - 10. Concealed pipes, ducts, and conduits.

1.2 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications: Shop-primed items.
- B. Section 09 91 13 - Exterior Painting.

1.3 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.
- B. Gloss Level 2: Flat refers to a lusterless or matte finish with a gloss range below 15 at 85 degrees, according to ASTM D 523.
- C. Gloss Level 4: Eggshell refers to low-sheen finish with a gloss range between 20 and 35 at 85 degrees, according to ASTM D 523.
- D. Gloss Level 5: Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 at 60 degrees, according to ASTM D 523.
- E. Gloss Level 6: Full gloss refers to high-sheen finish with a gloss range more than 70 at 60 degrees, according to ASTM D 523.

1.4 REFERENCE STANDARDS

- A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2024.
- B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020 (Reapproved 2025).
- C. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.

- D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- E. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- F. SSPC-SP 2 - Hand Tool Cleaning; 2024.
- G. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.
- H. SSPC-SP 13/NACE No.6 - Surface Preparation of Concrete; 2018.

1.5 SUBMITTALS

- A. See Section 01 31 50 - Submittal, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
 - 2. MPI product number (e.g., MPI #47).
 - 3. Cross-reference to specified paint system products to be used in project; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
 - 2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.
 - 3. Step coats on Samples to show each coat required for system.
 - 4. Label each coat of each Sample.
 - 5. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
 - 1. Cross-reference to finish system and locations of application areas. Use same designations indicated on Drawings and in schedules.
- E. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- 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. Label each container with color in addition to the manufacturer's label.

1.6 MOCK-UP

- A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.
- B. Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.8 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 fc measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
 - 1. Behr Process Corporation: www.behr.com/#sle.
 - 2. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
- C. Primer Sealers: Same manufacturer as top coats.

2.2 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
 - 1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
 - 2. 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.
 - 3. 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.
 - 4. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 - 5. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 6. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- 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.

2.3 ACCESSORY MATERIALS

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

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been adequately prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. Test shop-applied primer for compatibility with subsequent cover materials.
- E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
 - 1. Gypsum Wallboard: 12 percent.
 - 2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
 - 3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
 - 4. Concrete Floors and Traffic Surfaces: 8 percent.
- F.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 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 hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Acoustical Panel Ceilings:
 - 1. Pretreat ceiling water stains according to manufacturer's written instructions.
- G. Concrete:
 - 1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

2. Prepare surface as recommended by top coat manufacturer and in accordance with SSPC-SP 13/NACE No.6.
- H. Masonry:
 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 2. Prepare surface as recommended by top coat manufacturer.
- I. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- J. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- K. Galvanized Surfaces:
 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
 2. Prepare surface according to SSPC-SP 3.
- L. Ferrous Metal:
 1. Solvent clean according to SSPC-SP 1.
 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3. Protect from corrosion until coated.
- M. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

3.3 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
 1. Use applicators and techniques suited for paint and substrate indicated.
 2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- D. Application Procedure: Spray, back roll, plus two finish coats.
- E. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- F. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- G. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- H. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
- I. Sand wood and metal surfaces lightly between coats to achieve required finish.
- J. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.
 - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.
- K. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- L. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.
- 3.4 FIELD QUALITY CONTROL
- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection.
- B. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.
- 3.5 CLEANING
- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
- B. After completing paint and finish application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- 3.6 PROTECTION
- A. Protect finishes until completion of project.
- B. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- C. Touch-up damaged finishes after Substantial Completion.
- 3.7 SCHEDULE - MPI PAINT SYSTEMS
- A. Substrate: Ferrous Metal, Interior .
1. MPI System: INT 5.1RR - G5.
 - a. Primer: Alkyd, Anti-Corrosive for Metal; MPI # 79.
 - b. Intermediate Coat: High Performance Architectural Latex, Semi-Gloss; MPI # 141.
 - c. Topcoat: High Performance Architectural Latex, Semi-Gloss; MPI # 141.
- B. Substrate: Galvanized Metal, Interior .
1. MPI System: INT 5.3M - G5.
 - a. Primer: Water Based Galvanized Primer; MPI # 134.
 - b. Intermediate Coat: High Performance Architectural Latex, Semi-Gloss; MPI # 141.

- c. Topcoat: High Performance Architectural Latex, Semi-Gloss; MPI # 141.
- C. Substrate: Aluminum , Interior .
 - 1. MPI System: INT 5.4G - G5.
 - a. Primer: Quick Dry for Aluminum; MPI # 95.
 - b. Intermediate Coat: Institutional Low Odor/VOC Latex, Semi-Gloss; MPI # 147.
 - c. Topcoat: Institutional Low Odor/VOC Latex, Semi-Gloss; MPI # 147.
- D. Substrate: Gypsum Board, Interior .
 - 1. MPI System: INT 9.2M - G1. Flat Latex Finish:
 - a. Primer: Primer Sealer, Interior, Institutional Low Odor/VOC; MPI # 149.
 - b. Intermediate Coat: Institutional Low Odor/VOC Latex, Flat; MPI # 143.
 - c. Topcoat: Institutional Low Odor/VOC Latex, Flat; MPI # 143.
 - 2. MPI System: INT 9.2M - G3. Eggshell Enamel Finish:
 - a. Primer: Primer Sealer, Interior, Institutional Low Odor/VOC; MPI # 149.
 - b. Intermediate Coat: Institutional Low Odor/VOC Latex, Eggshell; MPI # 145.
 - c. Topcoat: Institutional Low Odor/VOC Latex, Eggshell; MPI # 145.
 - 3. MPI System: INT 9.2M - G5. Semi-Gloss Enamel Finish:
 - a. Primer: Primer Sealer, Interior, Institutional Low Odor/VOC; MPI # 149.
 - b. Intermediate Coat: Institutional Low Odor/VOC Latex, Semi-Gloss; MPI # 147.
 - c. Topcoat: Institutional Low Odor/VOC Latex, Semi-Gloss; MPI # 147.
 - 4. MPI System: INT 9.2B - G5. Epoxy Finish, Standard Non-Wet Areas:
 - a. Primer: Primer Sealer, Latex, Interior; MPI # 50.
 - b. Intermediate Coat: High Performance Architectural Latex, Semi-Gloss; MPI # 141.
 - c. Topcoat: High Performance Architectural Latex, Semi-Gloss; MPI # 141.
 - 5. MPI System: INT 9.2M - G1. Epoxy Finish, High Moisture or Wet Areas:
 - a. Primer: Primer Sealer, Latex, Interior; MPI # 50.
 - b. Intermediate Coat: Epoxy, High Build, Low Gloss; MPI # 108.
 - c. Topcoat: Epoxy, High Build, Low Gloss; MPI # 108.
- E. Substrate: Concrete Block, Interior .
 - 1. MPI System: INT 4.2A - G5. Semi-Gloss Enamel Finish:
 - a. Primer: Block Filler, Latex; MPI # 4.
 - b. Intermediate Coat: Latex, Interior, Semi-Gloss; MPI # 54.
 - c. Topcoat: Latex, Interior, Semi-Gloss; MPI # 54.
 - 2. MPI System: INT 4.2D - G5. Epoxy Finish, Standard Non-Wet Areas:
 - a. Primer: Block Filler, Latex; MPI # 4.
 - b. Topcoat: High Performance Architectural Latex, Semi-Gloss; MPI # 141.
 - 3. MPI System: INT 4.2R - G6. Epoxy Finish:
 - a. Primer: Block Filler, Epoxy; MPI # 116.
 - b. Topcoat: Epoxy, High Build, Gloss; MPI # 98.
- F. Substrate: Wood, Interior .
 - 1. Transparent Finish: Refer to Section 09 93 00
 - 2. MPI System: INT 6.3T - G5.
 - a. Primer: Primer, Latex, for Interior Wood; MPI # 39.
 - b. Intermediate Coat: Latex, Interior, Semi-Gloss; MPI # 54.
 - c. Topcoat: Latex, Interior, Semi-Gloss; MPI # 54.

END OF SECTION

SECTION 10 14 23 - PANEL SIGNAGE

PART 1 GENERAL

- 1.1 Section Includes
 - A. Panel signage.
- 1.2 Reference Standards
 - A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
 - B. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- 1.3 Submittals
 - A. See Section 01 31 50 - Submittals 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.
 - D. Samples: Submit two samples 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. Verification Samples: Submit samples showing colors, materials, and finishes specified.
 - G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

PART 2 PRODUCTS

- 2.1 Manufacturers
 - A. Panel Signage:
 - 1. Inpro Corporation: www.inprocorp.com/#sle.
 - 2. Ellet.
 - 3. Columbus Signs.
 - 4. Great Impressions - Greg Kitzmiller - 614-428-8290
- 2.2 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.
- 2.3 Panel Signage
 - A. Panel Signage:
 - 1. Application: Room, Door, Interior Directional and Information signs.
 - 2. Description: Flat signs with engraved panel media, tactile characters.
 - 3. Sign Size: As indicated on drawings.
 - 4. Total Thickness: 1/8 inch.

5. Color and Font, unless otherwise indicated:
 - a. Character Font: Helvetica, Arial, or other sans serif font.
 - b. Character Case: Upper and lower case (title case).
 - c. Background Color: As scheduled.
 - d. Character Color: Contrasting color.
6. Material: Acrylic plastic base with applied plastic letters and braille.
7. Profile: Flat panel without frame.
8. Tactile Letters: Raised 1/32 inch minimum.
9. Braille: Grade II, ADA-compliant.
10. One-Sided Wall Mounting: Tape adhesive.

2.4 Accessories

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

PART 3 EXECUTION

3.1 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.

3.2 Installation

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

END OF SECTION

SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Commercial toilet accessories.
- B. Commercial shower and bath accessories.
- C. Residential toilet, shower, and bath accessories.
- D. Under-lavatory pipe supply covers.
- E. Utility room accessories.

1.2 RELATED REQUIREMENTS

- A. Section 22 40 00 - Plumbing Fixtures: Under-lavatory pipe and supply covers.

1.3 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2025.
- C. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
- D. ASTM C1036 - Standard Specification for Flat Glass; 2025.
- E. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2024.
- F. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

1.4 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.

1.5 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. Samples: Submit two samples of each accessory, illustrating color and finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Commercial Toilet, Shower, and Bath Accessories:
 - 1. As indicated in Owner provided schedule
- B. Under-Lavatory Pipe Supply Covers:

1. Plumberex Specialty Products, Inc: www.plumberex.com/#sle.
2. IPS Corporation.
3. Buckaroos, Inc..

2.2 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. Keys: Provide 6 keys for each accessory to Owner; master key lockable accessories.
- C. Stainless Steel Sheet: ASTM A666/A666M, Type 304.
- D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- E. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
- F. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.3 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.
- B. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.

2.4 Commercial Toilet Accessories

2.5 Commercial Shower and Bath Accessories

- A. As indicated on Owner provided schedule or below.
- B. Folding Shower Seat for 30" x 60" Shower (**T-15**): Wall-mounted surface; welded tubular seat frame, structural support members, hinges, and mechanical fasteners of Type 304 stainless steel, L-shaped, right hand and L-shaped, left hand seat.
 1. Seat: Phenolic or polymeric composite one-piece seat or seat slats, of color as selected.
 2. Size: ADA Standards compliant.
 3. Basis of Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc.; Reversible Solid Phenolic Folding Shower Seat B-5181 or a comparable product by one of the following:
 - a. American Specialties, Inc. .
 - b. Bradley Corporation.
 - c.

2.6 Residential Toilet, Shower, and Bath Accessories

2.7 As indicated on Owner provided schedule.

- A. Medicine Cabinet (**T-22**): One-piece construction of heavy-gauge steel with factory-applied, gloss white, baked enamel finish, fully recessed, satin finish stainless steel mirror frame.
 1. Shelves: Adjustable, aluminum or glass; provide not less than 3 shelves.
 2. Door: Fitted with continuous piano-type hinge, shock-absorbing spring-and-rod door stop, magnetized catch, swing as indicated.
 3. Basis of Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc.; Recessed Medicine Cabinet, B397 or a comparable product by one of the following:
 - a. American Specialties, Inc: www.americanspecialties.com/#sle.
 - b. Bradley Corporation.
 - c. GAMCO Commerical Restroom Accessories: a division of Bobrick.

2.8 UNDER-LAVATORY PIPE AND SUPPLY COVERS

- A. Under-Lavatory Pipe and Supply Covers **(T-23)**:
1. Insulate exposed drainage piping, including hot, cold, and tempered water supplies under lavatories or sinks to comply with ADA Standards.
 2. Construction: 1/8 inch flexible PVC.
 - a. Microbial and Fungal Resistance: Comply with ASTM G21.
 3. Color: White.
 4. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces.
 5. Basis of Design Product: Subject to compliance with requirements, provide Truebro by IPS Corporation; or a comparable product by one of the following:
 - a. Plumberex Specialty Products, Inc; www.plumberex.com/#sle.
 - b. Buckaroos, Inc..

2.9 Utility Room Accessories

- A. Mop and Broom Holder **(T-26)**: 22 gauge thick stainless steel, Type 304, hat-shaped channel.
1. Holders: Three spring-loaded rubber cam holders.
 2. Length: 24 inches.
 3. Basis of Design Product: Subject to compliance with requirements; provide Bobrick Washroom Equipment, Inc.; B-223x24 or a comparable product by one of the following:
 - a. American Specialties, Inc: www.americanspecialties.com/#sle.
 - b. Bradley Corporation.
 - c. GAMCO Commerical Restroom Accessories: a division of Bobrick.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.

3.2 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

END OF SECTION

SECTION 10 31 00 - MANUFACTURED FIREPLACES

PART 1 GENERAL

- 1.1 Section Includes
 - A. Electric fireplaces.
- 1.2 Reference Standards
 - A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
 - B. UL 2021 - Fixed and Location Dedicated Electric Room Heaters; Current Edition, Including All Revisions.
- 1.3 Submittals
 - A. See Section 01 31 50 - Submittals for submittal procedures.
 - B. Products and materials specified in this Section are subject to the Build America, Buy America (BABA) requirements described in Division 01. Submit BABA Compliance Documentation demonstrating that products comply with HUD BABA requirements prior to procurement. Products not meeting BABA requirements shall not be incorporated into the Work.
 - C. Product Data: Provide firebox cabinet dimensions, clearances required from adjacent dissimilar construction, applicable regulatory agency approvals, and electrical characteristics of fan.
 - D. Executed warranty.
- 1.4 Warranty
 - A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
 - B. Manufacturer Warranty: Provide 2-year manufacturer warranty for _____. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

- 2.1 Electric Fireplaces
 - A. Manufacturers:
 - 1. FPI Fireplace Products International, Inc; ____: www.regency-fire.com/#sle.
 - 2. Superior Fireplaces; ____: www.superiorfireplaces.us.com/#sle.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.
 - B. Description:
 - 1. Location: Indoor.
 - 2. Fireplace Style: Traditional.
 - 3. Power Connection: Plug-in.
 - 4. Btu Rating: ____.
 - 5. Built-in fireboxes.
 - C. Design Criteria:
 - 1. Comply with UL 2021 for electric room heating equipment.

2.2 Components

- A. Firebox: Formed insulated steel cabinet with rectangular-shaped interior, configured to include chimney outlet and cleanout, refractory brick lining, and _____.

PART 3 EXECUTION

3.1 Verification of Conditions

- A. Verify prepared openings are ready to receive work and opening dimensions are as indicated on drawings.
- B. Verify proper power supply and fuel source are available.

3.2 Installation

- A. Comply with applicable code for clearances from adjacent materials, chimney height above roof line requirements, and unit UL approval.
- B. Perform electrical work in accordance with NFPA 70.
- C. Install unit assembly in accordance with manufacturer's instructions.

END OF SECTION

SECTION 10 44 00 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

- 1.1 Section Includes
 - A. Fire extinguishers.
 - B. Fire extinguisher cabinets.
- 1.2 Related Requirements
 - A. Section 06 10 00 - Rough Carpentry: Wood blocking.
 - B. Section 09 91 23 - Interior Painting.
- 1.3 Reference Standards
 - A. FM (AG) - FM Approval Guide; Current Edition.
 - B. NFPA 10 - Standard for Portable Fire Extinguishers; 2017, with Errata (2018).
 - C. UL (DIR) - Online Certifications Directory; Current Edition.
- 1.4 Submittals
 - A. See Section 01 31 50 - Submittals for submittal procedures.
 - B. Products and materials specified in this Section are subject to the Build America, Buy America (BABA) requirements described in Division 01. Submit BABA Compliance Documentation demonstrating that products comply with HUD BABA requirements prior to procurement. Products not meeting BABA requirements shall not be incorporated into the Work.
 - C. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, color and finish, and installation instructions.
- 1.5 Field Conditions
 - A. Do not install extinguishers when ambient temperature causes freezing of extinguisher ingredients.

PART 2 PRODUCTS

- 2.1 Manufacturers
 - A. Fire Extinguishers:
 - 1. Activar Construction Products Group, Inc. - JL Industries; Cosmic Extinguisher - Multipurpose Chemical: www.activarcpg.com/#sle.
 - 2. Ansul, a Tyco Business; Cleanguard: www.ansul.com/#sle.
 - 3. Fire-End & Croker Corporation: www.croker.com/#sle.
 - 4. Oval Brand Fire Products; Oval Dry Chemical Fire Extinguisher - Multipurpose ABC: www.ovalfireproducts.com/#sle.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
 - B. Fire Extinguisher Cabinets and Accessories:
 - 1. Activar Construction Products Group, Inc. - JL Industries; Ambassador Series: www.activarcpg.com/#sle.
 - 2. Fire-End & Croker Corporation: www.croker.com/#sle.
 - 3. Larsen's Manufacturing Co: www.larsensmfg.com/#sle.

4. Oval Brand Fire Products; Cabinets for Low Profile Extinguishers: www.ovalfireproducts.com/#sle.
5. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 Fire Extinguishers

- A. General Requirements: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
 1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated on drawings.
- B. Multipurpose Dry-Chemical-Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
 1. Class: A:B:C.
 2. Size: 5 pound.
 3. Temperature Range: Minus 65 to 120 degrees F.
- C. Wet Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gauge.
 1. Class: K.
 2. Size: 1.6 gal.
 3. Finish: Polished stainless steel.
 4. Temperature Range: Minus 20 to 120 degrees F.

2.3 Fire Extinguisher Cabinets

- A. Cabinet Construction: Non-fire rated.
 1. Formed primed steel sheet; 20-gauge, 0.036-inch thick base metal.
- B. Cabinet Configuration: Semi-recessed type.
 1. Size to accommodate accessories.
 2. Trim: Flat rolled edge, with 2-1/2" inch wide face.
 3. Provide cabinet enclosure with right-angle inside corners and seams and with formed perimeter trim and door stiles.
- C. Door: 20-gauge, 0.036-inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180-degree opening with two butt hinges.
- D. Door Glazing: Float glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.
- E. Cabinet Mounting Hardware: Appropriate to cabinet, with predrilled holes for placement of anchors.
- F. Fabrication: Weld, fill, and grind components smooth.
- G. Finish of Cabinet Exterior Trim and Door: Primed for field paint finish.
 1. See Section 09 91 23 for field painting.
- H. Finish of Cabinet Interior: White colored enamel.

2.4 Accessories

- A. Lettering: FIRE EXTINGUISHER text on decal or self-adhesive vinyl, prespaced black lettering in accordance with authorities having jurisdiction.

PART 3 EXECUTION

3.1 Examination

- A. Verify dimensions, tolerances, and interfaces with other work.
- B. Verify substrate and site conditions for product installation are in accordance with manufacturer's written instructions.

- C. Verify rough openings for cabinet are sized and located in accordance with manufacturer's written instructions.
- D. Notify Architect in writing of conditions detrimental to completion of work. Do not proceed with installation until detrimental conditions are corrected.

3.2 Installation

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

3.3 Maintenance

- A. See Section 01 70 00 - Execution Requirements for additional requirements.

END OF SECTION

SECTION 10 55 00 - POSTAL SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Central mail delivery boxes.

1.2 REFERENCE STANDARDS

- A. 39 CFR 111 - U.S. Postal Service Standard 4C; Current Edition.

1.3 SUBMITTALS

- A. See Section 01 31 50 - Submittals, for submittal procedures.
- B. Products and materials specified in this Section are subject to the Build America, Buy America (BABA) requirements described in Division 01. Submit BABA Compliance Documentation demonstrating that products comply with HUD BABA requirements prior to procurement. Products not meeting BABA requirements shall not be incorporated into the Work.
- C. Product Data: Provide manufacturer's specifications and descriptive literature, installation instructions, maintenance information, and current USPS approval documentation.
- D. Shop Drawings: Indicate plans for each unit or groups of units, front elevations with compartment layout and model number, overall dimensions, rough-in opening sizes, construction and anchorage details.

PART 2 PRODUCTS

2.1 CENTRAL MAIL DELIVERY BOXES

- A. Manufacturers:
 - 1. Florence Manufacturing Company: www.florencemailboxes.com/#sle.
 - 2. Jensen Mailboxes; _____: www.jensenmailboxes.com/#sle.
 - 3. Postal Products Unlimited, Inc; _____: www.postalproducts.com/#sle.
 - 4. Salsbury Industries: www.mailboxes.com/#sle.
 - 5. Security Manufacturing Corp; _____: www.securitymanufacturing.com/#sle.
 - 6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Central Mail Delivery Boxes: Provide products approved for United States Postal Service (USPS) delivery.
 - 1. Materials: Aluminum with stainless steel hardware.
 - 2. Finish: Powder coat in color selected by Architect from manufacturer's standard colors.
 - 3. Unit Types and Sizes: As indicated on drawings.
 - 4. Configurations: See drawings for overall dimensions and layouts.
- C. Wall-Mounted Mailboxes: Fully-recessed, complying with 39 CFR 111 (USPS-STD-4C).

2.2 COMPONENTS

- A. Locking - Front Loading Master Door: Three-point latching mechanism with USPS master lock furnished and installed by postmaster.
- B. Identification - Customer and Parcel Compartments: Sequential numerical or alphabetic characters, top to bottom, left to right; factory-installed.
 - 1. Customer Name Marking: Name card holder, sized to hold 3/4 inch high by minimum 2-1/2 inch long name card; attach above or inside each compartment.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that rough-openings are ready to receive wall-mounted units.
- B. Do not begin installation until unacceptable conditions are corrected.

3.2 INSTALLATION

- A. Install postal specialties in accordance with approved shop drawings, manufacturer's instructions, and USPS requirements.
- B. Adjust and lubricate door hardware to operate properly.

END OF SECTION

SECTION 10 75 00 - FLAGPOLES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Aluminum Flagpoles.

1.2 REFERENCE STANDARDS

- A. AASHTO M 36 - Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains; 2024.
- B. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube; 2022.
- C. NAAMM FP 1001 - Guide Specifications for Design Loads of Metal Flagpoles; 2007.

1.3 SUBMITTALS

- A. See Section 01 31 50 - Submittals, for submittal procedures.
- B. Products and materials specified in this Section are subject to the Build America, Buy America (BABA) requirements described in Division 01. Submit BABA Compliance Documentation demonstrating that products comply with HUD BABA requirements prior to procurement. Products not meeting BABA requirements shall not be incorporated into the Work.
- C. Product Data: Provide data on pole, accessories, and configurations.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Flagpoles:
 - 1. Concord American Flagpole; Internal - Independence: www.concordamericanflagpole.com/#sle.
 - 2. Morgan-Francis Flagpoles & Accessories; ____: www.morgan-francis.com/#sle.
 - 3. Pole-Tech Co, Inc; ____: www.poletech.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 FLAGPOLES

- A. Flagpoles: Designed in accordance with NAAMM FP 1001
 - 1. Material: Aluminum.
 - 2. Design: Cone tapered.
 - 3. Mounting: Ground mounted type.
 - 4. Nominal Height: 30 ft; measured from nominal ground elevation.
 - 5. Halyard: Internal type, manual winch operation.

2.3 POLE MATERIALS

- A. Aluminum: ASTM B241/B241M , 6063 alloy , T6 temper.

2.4 ACCESSORIES

- A. Finial Ball: Aluminum, 6 inch diameter.
- B. Halyard: 5/16 inch diameter nylon, braided, white.

2.5 OPERATORS

- A. Hand Crank: Removable _____ type.

2.6 MOUNTING COMPONENTS

- A. Foundation Tube Sleeve: AASHTO M 36, corrugated 16 gauge, 0.0598 inch steel, galvanized, depth of _____ inches as indicated.

2.7 FINISHING

- A. Aluminum: Mill finish.

PART 3 EXECUTION

3.1 EXAMINATION

3.2 PREPARATION

3.3 INSTALLATION

- A. Install flagpole , base assembly, and fittings in accordance with manufacturer's instructions.
B. Install foundation plate and centering wedges for flagpoles base set in concrete base and fasten.

3.4 TOLERANCES

- A. Maximum Variation From Plumb: 1 inch.

3.5 ADJUSTING

- A. Adjust operating devices so that halyard and flag function smoothly.

END OF SECTION

SECTION 11 30 13 - RESIDENTIAL APPLIANCES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Kitchen appliances.
- B. Laundry appliances.

1.2 RELATED REQUIREMENTS

- A. Section 22 10 05 - Plumbing Piping: Plumbing connections for appliances.
- B. Section 26 05 83 - Wiring Connections: Electrical connections for appliances.

1.3 REFERENCE STANDARDS

1.4 SUBMITTALS

- A. See Section 01 31 50 - Submittals, for submittal procedures.
- B. Products and materials specified in this Section are subject to the Build America, Buy America (BABA) requirements described in Division 01. Submit BABA Compliance Documentation demonstrating that products comply with HUD BABA requirements prior to procurement. Products not meeting BABA requirements shall not be incorporated into the Work.
- C. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.
- D. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

PART 2 PRODUCTS

2.1 KITCHEN APPLIANCES

- A. Provide Equipment Eligible for Energy Star Rating: Energy Star Rated.

2.2 LAUNDRY APPLIANCES

- A. Provide Equipment Eligible for Energy Star Rating: Energy Star Rated.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify utility rough-ins are provided and correctly located.

3.2 INSTALLATION

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

3.3 ADJUSTING

- A. Adjust equipment to provide efficient operation.

3.4 CLEANING

- A. Remove packing materials from equipment and properly discard.
- B. Wash and clean equipment.

END OF SECTION

SECTION 12 24 00 - WINDOW SHADES

PART 1 GENERAL

1.1 SECTION INCLUDES

1.2 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

1.3 REFERENCE STANDARDS

1.4 SUBMITTALS

- A. See Section 01 31 50 - Submittals, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.

1.5 DELIVERY, STORAGE, AND HANDLING

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

1.6 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.1 Manufacturers

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine finished openings for deficiencies that may preclude satisfactory installation.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Start of installation shall be considered acceptance of substrates.

3.2 PREPARATION

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

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.
- B. Replace shades that exceed specified dimensional tolerances at no extra cost to Owner.

- C. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.4 CLEANING

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

3.5 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate operation and maintenance of window shade system to Owner's personnel.

3.6 PROTECTION

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

END OF SECTION

SECTION 12 35 30 - RESIDENTIAL CASEWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Kitchen cabinets.
- B. Vanity cabinets.

1.2 RELATED REQUIREMENTS

- A. Section 07 92 00 - Joint Sealants: Sealing joints between casework and countertops and adjacent walls, floors, and ceilings.
- B. Section 12 36 00 - Countertops.

1.3 SUBMITTALS

- A. See Section 01 31 50 - Submittals, for submittal procedures.
- B. Product Data: Provide component dimensions, configurations, construction details, and joint details.
- C. Shop Drawings: Indicate casework locations, elevations, clearances required, rough-in and anchor placement dimensions and tolerances, and _____.
- D. Cabinet Finish Sample: Submit two samples of each type of finish, 2 inches by 3 inches in size, illustrating color, texture, gloss, and wood species.

1.4 MOCK-UP

- A. Provide full size mock-up of casework base unit.
- B. Locate where directed.
- C. Mock-up may remain as part of the Work.

PART 2 PRODUCTS

2.1 Cabinets

- A. Manufacturers:
 - 1. Kountry Wood, As indicated on the drawings.
- B. Kitchen and Vanity Cabinets: Premanufactured and factory-finished, complying with construction and testing requirements in KCMA A161.1.
- C. Cabinet Box: Manufacturer's standard materials and construction as determined by selected product line.

2.2 FABRICATION

- A. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.
- B. Fabricate corners and joints without gaps.
- C. Fabricate each unit to be rigid and not dependent on adjacent units for rigidity.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify adequacy of support framing.

3.2 INSTALLATION

- A. Install casework, components and accessories in accordance with manufacturer's instructions.
- B. Use anchoring devices to suit conditions and substrate materials encountered.
- C. Set casework items plumb and square, securely anchored to building structure.

3.3 ADJUSTING

- A. Adjust doors, drawers, hardware, and other moving or operating parts to function smoothly.

3.4 CLEANING

- A. Clean casework, countertops, shelves, and hardware.

3.5 PROTECTION

- A. Do not permit finished casework to be exposed to continued construction activity.

END OF SECTION

SECTION 12 36 00 - COUNTERTOPS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Countertops for manufactured casework.

1.2 RELATED REQUIREMENTS

- A. Section 12 32 00 - Manufactured Wood Casework.

1.3 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard; 2022.
- B. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications; 2022.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- E. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
- F. ISFA 3-01 - Classification and Standards for Quartz Surfacing Material; 2013.
- G. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- H. NSI (DSDM) - Dimensional Stone Design Manual, Version VIII; 2016.
- I. PS 1 - Structural Plywood; 2023.

1.4 SUBMITTALS

- A. See Section 01 31 50 - Submittals for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.
- D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.
- F. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Natural Stone Institute (NSI) Accredited Natural Stone Fabricator; www.naturalstoneinstitute.org/#sle.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.6 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.

1.7 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

2.1 COUNTERTOPS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Natural Quartz and Resin Composite Countertops: Sheet or slab of natural quartz and plastic resin over continuous substrate.
 - 1. Flat Sheet Thickness: 1-1/4 inch, minimum.
 - 2. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISFA 3-01 and NEMA LD 3; orthophthalic polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard stone fabrication tools; no surface coating; color and pattern consistent throughout thickness.
 - a. Manufacturers:
 - 1) As indicated on the drawings
 - b. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with NSI (DSDM).
 - c. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
 - d. Finish on Exposed Surfaces: Polished.
 - e. Color and Pattern: As selected by Architect from manufacturer's full line.
 - 3. Other Components Thickness: 3/4 inch, minimum.
 - 4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; radiused edge; use marine edge at sinks.
 - 5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
 - 6. Fabricate in accordance with manufacturer's standard requirements.

2.2 MATERIALS

- A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
- B. Particleboard for Supporting Substrate: ANSI A208.1 Grade 2-M-2, 45 pcf minimum density; minimum 3/4 inch thick; join lengths using metal splines.
- C. Medium Density Fiberboard for Supporting Substrate: ANSI A208.2.
- D. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

2.3 ACCESSORIES

- A. Grommets for Cable Passage through Countertops: 2-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.
 - 1. Products:
 - a. Doug Mockett & Company, Inc.

2.4 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 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, unless otherwise indicated.

PART 3 EXECUTION

3.1 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.

3.2 PREPARATION

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

3.3 INSTALLATION

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

3.4 TOLERANCES

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

3.5 CLEANING

- A. Clean countertops surfaces thoroughly.

3.6 PROTECTION

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

END OF SECTION

SECTION 14 24 00 - HYDRAULIC ELEVATORS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Complete hydraulic elevator systems.
 - 1. Passenger type.
 - 2. Service type.
- B. Elevator Maintenance Contract.

1.2 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Includes elevator machine foundation, enclosed hoistway, elevator pit, divider beams, overhead hoist beams, grouting thresholds, grouting hoistway entrance frames, and _____.
- B. Section 04 20 00 - Unit Masonry: Masonry hoistway enclosure; building-in and grouting hoistway door frames.
- C. Section 05 12 00 - Structural Steel Framing: Includes hoistway framing, divider beams, overhead hoist beams, and _____.
- D. Section 05 50 00 - Metal Fabrications: Includes elevator pit ladder, sill supports, divider beams, overhead hoist beams, and _____.
- E. Section 07 84 00 - Firestopping: Fire rated sealant in hoistway.
- F. Section 08 31 00 - Access Doors and Panels: Fire rated access doors into hoistway.
- G. Section 09 65 00 - Resilient Flooring: Floor finish in car.
- H. Section 10 44 00 - Fire Protection Specialties: Fire extinguisher in elevator machine room.
- I. Section 21 13 00 - Fire-Suppression Sprinkler Systems: Sprinkler heads in hoistway.
- J. Section 22 05 13 - Common Motor Requirements for Plumbing Equipment: Motor for sump pump in pit.
- K. Section 26 05 33.13 - Conduit for Electrical Systems:
- L. Section 26 05 83 - Wiring Connections:

1.3 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. AAMA 611 - Specification for Anodized Architectural Aluminum; 2024.
- C. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- D. AISC 360 - Specification for Structural Steel Buildings; 2022, with Errata (2025).
- E. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).
- F. 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.
- G. ASME A17.2 - Guide for Inspection of Elevators, Escalators, and Moving Walks Includes Inspection Procedures for Electric Traction and Winding Drum Elevators, Hydraulic Elevators, Inclined Elevators,

Limited-Use/Limited-Application Elevators, Private Residence Elevators, Escalators, Moving Walks, Dumbwaiters, and Material Lifts; 2023.

- H. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- I. ASTM A139/A139M - Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over); 2022.
- J. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2025.
- K. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.
- L. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
- M. 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; 2025.
- N. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- O. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- P. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2025.
- Q. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.
- R. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- S. NEMA MG 00001 - Motors and Generators; 2024.
- T. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- U. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- V. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.
- W. PS 1 - Structural Plywood; 2023.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate work with other installers to provide conduits necessary for installation of wiring including but not limited to:
 - a. Elevator equipment devices remote from elevator machine room or hoistway.
 - b. Telephone service for machine room.
 - c. Elevator pit for lighting and sump pump.
 - d. Automatic transfer switch from controller cabinet.
 - e. Fire alarm panel from controller cabinet.
- B. Preinstallation Meeting: Convene meeting at least one week prior to start of this work.
 - 1. Review schedule of installation, proper procedures and conditions, and coordination with related work.
- C. Construction Use of Elevator: Not permitted.

1.5 SUBMITTALS

- A. See Section 01 31 50 - Submittals for submittal procedures.
- B. Products and materials specified in this Section are subject to the Build America, Buy America (BABA) requirements described in Division 01. Submit BABA Compliance Documentation demonstrating that products comply with HUD BABA requirements prior to procurement. Products not meeting BABA requirements shall not be incorporated into the Work.
- C. Product Data: Submit data on following items:
 - 1. Signal and operating fixtures, operating panels, and indicators.
 - 2. Car design, dimensions, layout, and components.
 - 3. Car and hoistway door and frame details.
 - 4. Electrical characteristics and connection requirements.
- D. Shop Drawings: Include appropriate plans, elevations, sections, diagrams, and details on following items:
 - 1. Elevator Equipment and Machines: Size and location of driving machines, power units, controllers, governors, and other components.
 - 2. Hoistway Components: Size and location of car guide rails, buffers, jack unit and other components.
 - 3. Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.
 - 4. Individual weight of principal components; load reaction at points of support.
 - 5. Clearances and over-travel of car.
 - 6. Locations in hoistway and machine room of traveling cables and connections for car lighting and telephone.
 - 7. Location and sizes of hoistway and car doors and frames.
 - 8. Calculated heat dissipation of elevator equipment in machine room.
 - 9. Electrical characteristics and connection requirements.
 - 10. Indicate arrangement of elevator equipment and allow for clear passage of equipment through access openings.
- E. Samples: Submit samples illustrating car interior finishes, car and hoistway door and frame finishes, and handrail material and finish in the form of cut sheets or finish color selection brochures.
- F. Initial Maintenance Contract.
- G. Maintenance Contract: Submit proposal to Owner for standard one year continuing maintenance contract agreement in accordance with ASME A17.1 and requirements as indicated, starting on date initial maintenance contract is scheduled to expire.
 - 1. Indicate in proposal the services, obligations, conditions, and terms for agreement period and for renewal options.
- H. Operation and Maintenance Data:
 - 1. Parts catalog with complete list of equipment replacement parts; identify each entry with equipment description and identifying code.
 - 2. Operation and maintenance manual.
 - 3. Schematic drawings of equipment and hydraulic piping, and wiring diagrams of installed electrical equipment with list of corresponding symbols to identify markings on machine room and hoistway apparatus.
- I. Specimen warranty.
- J. Executed warranty.

1.6 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 1-year manufacturer warranty for elevator operating equipment and devices. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Hydraulic Elevator Manufacturers:
 - 1. Otis Elevator Company; HydroFit: www.otis.com/#sle.
 - 2. TK Elevator; Endura: www.tkelevator.com/#sle.
 - 3. Alliance Elevator Solutions; ADVANTAGE Hydraulic : <https://www.allianceelevator.net/hydraulic.htm>.
- B. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Source Limitations: Provide elevator and associated equipment and components produced by a single manufacturer and obtained from a single supplier.
 - 1. Controllers are to be non-proprietary from the following:
 - a. GAL
 - b. ECS
 - c. Smartrise
 - d. Approved Equal

2.2 HYDRAULIC ELEVATORS

- A. Hydraulic Passenger Elevator, No. 2:
 - 1. Hydraulic Elevator Equipment:
 - a. Holeless hydraulic with cylinder mounted within hoistway.
 - 2. Drive System:
 - a. Variable voltage variable frequency (VVVF) to modulate motor speed.
 - 3. Operation Control Type:
 - a. Two-Car Selective Collective Automatic (Duplex Collective Automatic) Operation Control.
 - 4. Service Control Types:
 - a. Standard service control.
 - b. Independent service control.
 - 5. Interior Car Height: 95 inch.
 - 6. Electrical Power: 208 volts; alternating current (AC); three phase; 60 Hz.
 - 7. Rated Net Capacity: 3500 pounds.
 - 8. Rated Speed: 150 feet per minute.
 - 9. Hoistway Size: As indicated on drawings.
 - 10. Interior Car Platform Size: As indicated on drawings.
 - 11. Elevator Pit Depth: 48 inch.
 - 12. Overhead Clearance at Top Floor: 154 inch.
 - 13. Travel Distance: As indicated on drawings.
 - 14. Number of Stops: 3.
 - 15. Number of Openings: 3 Front.
 - 16. Hydraulic Equipment Location: As indicated on drawings
- B. Hydraulic Service Elevator, No. 1:
 - 1. Hydraulic Elevator Equipment:
 - a. Holeless hydraulic with cylinder mounted within hoistway.
 - 2. Drive System:
 - a. Variable voltage variable frequency (VVVF) to modulate motor speed.
 - 3. Operation Control Type:
 - a. Two-Car Selective Collective Automatic (Duplex Collective Automatic) Operation Control.
 - 4. Service Control Types:
 - a. Standard service control.
 - b. Independent service control.
 - c. Restricted Access service control.
 - 5. Interior Car Height: 95 inch.
 - 6. Electrical Power: 208 volts; alternating current (AC); three phase; 60 Hz.

7. Freight Car Loading Classification: Class A - General Freight Loading in compliance with ASME A17.1.
8. Rated Net Capacity: 4500 pounds.
9. Rated Speed: 150 feet per minute.
10. Hoistway Size: As indicated on drawings.
11. Interior Car Platform Size: As indicated on drawings.
12. Elevator Pit Depth: 48 inch.
13. Overhead Clearance at Top Floor: 154 inch.
14. Travel Distance: As indicated on drawings.
15. Number of Stops: 3.
16. Number of Openings: 3 Front; 1 Rear.
17. Hydraulic Equipment Location: As indicated on drawings.

2.3 COMPONENTS

- A. Elevator Equipment:
 1. Motors, Hydraulic Equipment, Controllers, Controls, Buttons, Wiring, Devices, and Indicators: Comply with NFPA 70.
 2. Guide Rails, Cables, Buffers, Attachment Brackets and Anchors: Design criteria for components includes safety factors in accordance with applicable requirements of Elevator Code, ASME A17.1.
 3. Buffers:
 - a. Spring type for elevators with speed less than or equal to 200 fpm.
 4. Lubrication Equipment:
 - a. Provide grease fittings for periodic lubrication of bearings.
 - b. Lubrication Points: Visible and easily accessible.
- B. Electrical Equipment:
 1. Motors: NEMA MG 1.
 2. Boxes, Conduit, Wiring, and Devices: As required by NFPA 70.
 3. Sump Pump in Pit: See Section 22 05 13.
 4. Spare Conductors: Provide ten percent in extra conductors and two pairs of shielded audio cables in traveling cables.
 5. Include wiring and connections to elevator devices remote from hoistway and between elevator machine room. Provide additional components and wiring to suit machine room layout. See Section 26 05 83.

2.4 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).
- B. Accessibility Requirements: Comply with ADA Standards.
- C. Perform structural steel design, fabrication, and installation in accordance with AISC 360.
- D. Perform welding of steel in accordance with AWS D1.1/D1.1M.
- E. Fabricate and install door and frame assemblies in accordance with NFPA 80 and in compliance with requirements of authorities having jurisdiction.
- F. Perform electrical work in accordance with NFPA 70.
- G. Comply with venting or pressurization of hoistway design in accordance with HVAC system requirements and authorities having jurisdiction (AHJ).
- H. Comply with fire protection sprinkler system of hoistway design in accordance with NFPA 13 requirements and authorities having jurisdiction (AHJ).

2.5 OPERATION CONTROLS

- A. Elevator Controls: Provide landing operating panels and landing indicator panels.

1. Landing Operating Panels: Metallic type, one for originating "Up" and one for originating "Down" calls, one button only at terminating landings; with illuminating indicators.
 2. Landing Indicator Panels: Illuminating.
 3. Comply with ADA Standards for elevator controls.
- B. Interconnect elevator control system with building fire alarm and smoke alarm systems.
- C. Door Operation Controls:
1. Program door control to open doors automatically when car arrives at floor landing.
 2. Render "Door Close" button inoperative when car is standing at dispatch landing with doors open.
 3. Door Safety Devices: Moveable, retractable safety edges, quiet in operation; equipped with photo-electric light rays.
- D. Provide "Firefighter's Emergency Operation" in accordance with ASME A17.1, applicable building codes, and authorities having jurisdiction (AHJ).
1. Designated Landing: Main Lobby.

2.6 OPERATION CONTROL TYPE

- A. Two-Car Selective Collective Automatic (Duplex Collective Automatic) Operation Control: Applies to cars in two elevator shafts .
1. Park one car at main floor and designate other as free car, at landing last served or at a predetermined upper floor landing.
 2. Arrange free car to answer landing calls either above or below landing where car is standing except main floor landing calls.
 3. When free car is answering calls, automatically start an alternate car to answer landing calls under any of the following conditions:
 - a. Registration of up calls from landings below the free car while it is traveling up by alternate car below.
 - b. Registration of up or down calls from landings above the free car while it is traveling down by alternate car.
 - c. Free car fails to clear registered landing calls within 40 seconds, or to move alternate car in response to registered landing calls within this time frame.
 4. Register and answer calls by momentary pressure on one or more car buttons; cause car to respond.
 5. Once started, either in response to car button calls, or to landing button calls, respond to calls registered for the direction of the traveling car in the order that landings are reached, regardless of sequence that calls were registered.
 6. Allow only one car to stop in response to any one landing call.
 7. Return first free car to main floor after answering landing calls.
 8. Should both cars finish their calls at main floor, designate one car as the free car.
 9. If no car buttons are pressed and car starts up in response to several landing down calls, proceed first to the highest landing down call, then reverse to collect other landing down calls. Collect up calls similarly when car starts down in response to such calls.
 10. If a car stops for a landing call, and car button matching direction the car was traveling is pressed within a predetermined time interval after a landing stop, proceed in the same direction regardless of other landing calls that are registered.
 11. If down landing buttons are pressed while car is traveling up, do not stop at those landings but allow those calls to remain registered for answering by the next down traveling car.
 12. After the highest car has responded to up landing calls, reverse car automatically and respond to down landing calls.
 13. When traveling down, a car will not respond to up calls. Allow those up calls to remain registered to be answered by next available car on an up trip.
 14. Include a time delay to hold car for an adjustable time interval at landings where stops are made to enable passengers to enter or leave the car. Cancel the time interval upon registration of a car call or pressure on the car door close button.
 15. Permit a registered car call to establish the direction of travel when a car has answered the farthest car call, even if other landing calls are registered.
 16. Answer calls to the basement landing with the car that is normally parked at the main floor unless the free car is at the basement.
 17. If a car is removed from service, the other car shall answer landing calls.

2.7 SERVICE CONTROL TYPE

- A. Independent Service Control:
 - 1. Provide key operated "Independent Service" on car operating panel. Key activation will remove that car from normal operation and cancel pre-registered car calls.
 - 2. Car will respond to selected floor. Car will not respond to any calls from landing call buttons. Car will only respond to calls placed on the car operating panel. Doors will remain open at last landing requested. Doors will close with a constant pressure on "Door Close" button.
 - 3. Key activation to normal operation will return car to normal operation.
- B. Restricted Access Service Control:

2.8 MATERIALS

- A. Steel Cylinder Casing: ASTM A139/A139M, Grade A steel.
- B. Rolled Steel Sections, Shapes, Rods: ASTM A36/A36M.
- C. Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel), with matte finish.
- D. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- E. Stainless Steel Sheet: ASTM A666/A666M, Type 304; No. 4 Brushed finish unless otherwise indicated.
- F. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.
- G. Extruded Aluminum: ASTM B221 (ASTM B221M), natural anodized finish unless otherwise indicated.
- H. Plywood: PS 1, Structural I, Grade C-D or better, sanded.
- I. Tempered Glass: 3/8 inch minimum thickness, fully tempered in compliance with ASME A17.1, 16 CFR 1201, ANSI Z97.1, and ASTM C1048 tempered glass requirements.
- J. Resilient Flooring: Vinyl tile flooring and Resilient base, see Section 09 65 00, Type ____.
- K. Plastic Laminate: NEMA LD 3, Type HGS, color as selected by Architect from manufacturer's standard line of colors.

2.9 CAR AND HOISTWAY ENTRANCES

- A. Elevator, No. 1:
 - 1. Car and Hoistway Entrances, Each Elevator Floor Lobby:
 - a. Hoistway Fire Rating: 1 Hour.
 - b. Framed Opening Finish and Material: Brushed stainless steel.
 - c. Car Door Material: Stainless steel, with rigid sandwich panel construction.
 - d. Hoistway Door Material: Stainless steel, with rigid sandwich panel construction.
 - e. Door Type: Double leaf.
 - f. Door Operation: Side opening, two speed.
 - g. Door Width: 48 inches.
 - h. Door Height: 84 inches.
 - i. Sills: Extruded aluminum.
- B. Elevator, No. 2:
 - 1. Car and Hoistway Entrances, Each Elevator Floor Lobby:
 - a. Hoistway Fire Rating: 1 Hour.
 - b. Framed Opening Finish and Material: Brushed stainless steel.
 - c. Car Door Material: Stainless steel, with rigid sandwich panel construction.
 - d. Hoistway Door Material: Stainless steel, with rigid sandwich panel construction.
 - e. Door Type: Single leaf.
 - f. Door Operation: side opening, one speed.
 - g. Door Width: 42 inches.
 - h. Door Height: 84 inches.

- C. Sills/Thresholds: Configure to align with frame return and coordinate with floor finish.
- D. Gasketing: Provide acoustic type gasketing at hoistway doors and frames to minimize audible noise due to car activities in the hoistway, and air pressure differential between hoistway and landing floors.

2.10 CAR EQUIPMENT AND MATERIALS

- A. Elevator Car:
 - 1. Car Operating Panel: Provide main and auxiliary; flush-mounted applied face plate, with illuminated call buttons corresponding to floors served with "Door Open" button, "Door Close" button, alarm button, and _____.
 - a. Panel Material: Integral with front return; one per car.
 - b. Car Floor Position Indicator: Above door with illuminating position indicators.
 - c. Locate alarm button where it is unlikely to be accidentally actuated; not more than 54 inch above car finished floor.
 - d. Provide matching service cabinet integral with front return panel, with hinged door and keyed lock in each car.
 - e. Provide following within service cabinet as part of car operating panel:
 - 1) Switch for each auxiliary operational control, keyed.
 - 2) Switches for fan, light, and inspection control.
 - 3) Telephone cabinet and hard-wired connection with hands-free telephone.
 - 2. Ventilation: Single speed fan with grille in ceiling.
 - 3. Flooring: Resilient vinyl tile.
 - 4. Front Return Panel: Match material of car door.
 - 5. Door Wall: Stainless steel.
 - 6. Side Walls: Plastic laminate on plywood.
 - 7. Rear Wall: Plastic laminate on plywood.
 - 8. Hand Rail: Stainless steel, at all three sides. Provide open clearance space 1-1/2 inch (38 mm) wide to face of wall.
 - a. Stainless Steel Finish: No. 4 Brushed.
 - 9. Ceiling:
 - a. Exposed Frame Suspended Ceiling: Plastic laminate on plywood, mount 7 inch below car canopy with 1-1/2 inch nominal space between edge of ceiling and wall.
 - b. Frame Finish: Color anodized aluminum.
 - c. Panel Finish: Finish as selected from manufacturers standard line.
 - d. Lighting: As selected from manufacturer's standard line.
- B. Car Accessories:
 - 1. Certificate Frame: Stainless steel frame glazed with tempered glass, and attached with tamper-proof screws.
 - 2. Protective Pads: Canvas cover, padded with impact-resistant fill material, sewn with piping edges; fire resistant in compliance with ASME A17.1; brass grommets for supports, covering side and rear walls and front return, with cut-out for control panel; provide one set for each elevator.
 - a. Color: Tan.
 - b. Provide at least 4 inch clearance from bottom of pad to finished floor.
 - c. Pad Supports: Stainless steel studs, and mounted from ceiling frame.

2.11 MACHINE ROOM FITTINGS

- A. Wall-Mounted Frames: Glazed with clear plastic; sized as required. Provide one chart each for master electric and hydraulic schematic and for lubrication chart. Install charts.
- B. Key Cabinet: Wall-mounted, lockable, keyed to building keying system, for control and operating panel keys.
 - 1. Provide two key cabinet keys.
 - 2. Provide two control/operating panel keys.

2.12 FINISHES

- A. Color Anodized Finish: Class I, AAMA 611 AA-M12C22A44, electrolytically deposited colored anodic coating not less than 0.7 mil, 0.0007 inch thick.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting this work.
- B. Verify that hoistway, pit, and machine room are ready for work of this section.
- C. Verify hoistway shaft and openings are of correct size and within tolerance.
- D. Verify location and size of machine foundation and position of machine foundation bolts.
- E. Verify that electrical power is available and of correct characteristics.

3.2 PREPARATION

- A. Arrange for temporary electrical power for installation work and testing of elevator components; see Section 01 50 00 - Temporary Facilities and Controls for additional requirements.
- B. Excavate for in-ground hydraulic cylinder casing and remove subsoil from site; see Section 31 23 16.
- C. Maintain in-ground shaft alignment of 1/2 inch maximum from plumb.
 - 1. Fill over-excavated shaft depth with lean concrete.
- D. Maintain elevator pit excavation free of water.
- E. Maintain in-ground elevator shaft excavation free of water.
- F. Place in-ground plunger casing full depth of shaft. Align to 1/4 inch from plumb. Cut top of casing at hoistway pit slab elevation.
- G. Backfill around in-ground cylinder casing; see Section 31 23 23.

3.3 INSTALLATION

- A. Coordinate this work with installation of hoistway wall construction.
- B. Install system components, and connect equipment to building utilities.
- C. Provide conduit, electrical boxes, wiring, and accessories; see Sections 26 05 33.13 and 26 05 83.
- D. Install hydraulic piping between cylinder and pump unit.
- E. Mount machines, motors, pumps, and _____ on vibration and acoustic isolators.
 - 1. Place on structural supports and bearing plates.
 - 2. Securely fasten to building supports.
 - 3. Prevent lateral displacement.
- F. Install hoistway, elevator equipment, and components in accordance with approved shop drawings.
- G. Install guide rails to allow for thermal expansion and contraction movement of guide rails.
- H. Accurately machine and align guide rails, forming smooth joints with machined splice plates.
- I. Field Welds: Chip and clean away oxidation and residue with wire brush; spot prime surface with two coats.

- J. Install hoistway door sills, frames, and headers in hoistway walls; grout sills in place, set hoistway floor entrances in alignment with car openings, and align plumb with hoistway.
- K. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent; prime two coats.
- L. Wood Surfaces not Exposed to Public View: Finish with one coat primer; one coat enamel.
- M. Adjust equipment for smooth and quiet operation.

3.4 TOLERANCES

- A. Guide Rail Alignment: Plumb and parallel to each other in accordance with ASME A17.1 and ASME A17.2.
- B. Car Movement on Aligned Guide Rails: Smooth movement, without any objectionable lateral or oscillating movement or vibration.

3.5 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Testing and inspection performed at discretion of regulatory agencies certified in accordance with ASME QEI 1.
- C. Operational Tests:
 - 1. Perform operational tests in the presence of Owner and Architect.
 - 2. At an agreed time, and the building occupied with normal building traffic, conduct tests to verify performance.
 - a. Furnish event recording of each landing call registrations, time initiated, and response time throughout entire working day.
 - 3. Set period of time elevator takes to travel between typical floor landings at not more than ____ seconds.
 - a. Measure time from moment doors start to close until car has stopped level at next floor landing and doors are opening.

3.6 ADJUSTING

- A. Adjust for smooth acceleration and deceleration of car to minimize passenger discomfort.
- B. Adjust with automatic floor leveling feature at each floor landing to reach 1/4 inch maximum from flush with sill.

3.7 CLEANING

- A. Remove protective coverings from finished surfaces.
- B. Clean surfaces and components in accordance with manufacturers written instructions.

3.8 CLOSEOUT ACTIVITIES

- A. Demonstrate proper operation of equipment to Owner's designated representative.

3.9 PROTECTION

- A. Do not permit construction traffic within car after cleaning.
- B. Protect installed products until Date of Substantial Completion.
- C. Touch-up, repair, or replace damaged products and materials prior to Date of Substantial Completion.

3.10 MAINTENANCE

- A. Provide Initial Maintenance Contract of elevator system and components in accordance with ASME A17.1 and requirements as indicated for 12 months from Date of Substantial Completion.
- B. Perform maintenance contract services using competent and qualified personnel under the supervision and direct employ of the elevator manufacturer or original installer.
- C. Include systematic examination, adjustment, and lubrication of elevator equipment.
- D. Maintain and repair or replace parts, whenever required, using parts produced by original equipment manufacturer.
- E. Perform work without removing cars from use during peak traffic periods.

END OF SECTION

SECTION 14 91 00 - FACILITY CHUTES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Trash chutes.

1.2 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Wood curb at roof vent.
- B. Section 07 62 00 - Sheet Metal Flashing and Trim: Counterflashing at chute roof vent.
- C. Section 21 13 00 - Fire-Suppression Sprinkler Systems: Connection to sprinklers inside chute.
- D. Section 22 10 05 - Plumbing Piping:
 - 1. Water piping connections to spray cleaning equipment.
- E. Section 26 05 83 - Wiring Connections:
 - 1. Connection of control panels to 110 VAC electrical power.
 - 2. Wiring and conduit between control panels and controlled components.
 - 3. Wiring and conduit between discharge room spray cleaning switch and flushing spray head.

1.3 REFERENCE STANDARDS

- A. ITS (DIR) - Directory of Listed Products; Current Edition.
- B. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.
- D. NFPA 82 - Standard on Incinerators and Waste and Linen Handling Systems and Equipment; 2024.
- E. UL (DIR) - Online Certifications Directory; Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene seven days before start of installation to review local building code requirements, manufacturer's recommendations, and related work.

1.5 SUBMITTALS

- A. See Section 01 31 50 - Submittal for additional requirements.
- B. Products and materials specified in this Section are subject to the Build America, Buy America (BABA) requirements described in Division 01. Submit BABA Compliance Documentation demonstrating that products comply with HUD BABA requirements prior to procurement. Products not meeting BABA requirements shall not be incorporated into the Work.
- C. Product Data: Manufacturer's printed data sheets on each component, indicating which options are provided.
- D. Shop Drawings: Provide detailed layout of chute and components, indicating interface with structure, enclosing walls, and utilities; include the following:
 - 1. Openings in floors and required clearances.
 - 2. Location and size of each field connection to structure.
 - 3. Pipe sizes and locations.
 - 4. Electrical wiring sizes, conduits, and location of connections.

- 5. Clearly indicate components required but not furnished by chute installer.
 - E. Test Reports: Submit for each test/inspection.
 - F. Executed warranty.
- 1.6 QUALITY ASSURANCE
- A. See Section 01 40 00 - Quality Requirements for additional requirements.
 - B. Products Requiring Electrical Connection: Listed and classified by UL (DIR), ITS (DIR), or testing agency acceptable to authorities having jurisdiction as suitable for indicated purpose being specified.
 - C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 for fire ratings indicated, that are listed and labeled by testing and inspecting agency acceptable to authorities having jurisdiction.
- 1.7 WARRANTY
- A. Manufacturer Warranty: Provide 2-year manufacturer warranty for facility chutes. Complete forms in Owner's name and register with manufacturer.
 - B. Installer Warranty: Provide 1-year warranty for facility chutes commencing on Date of Substantial Completion. Complete forms in Owner's name and register with installer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Facility Chutes:
 - 1. Wilkinson Hi-Rise; _____: www.whrise.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 FACILITY CHUTES

- A. Trash Chutes: Sheet metal, round, constant diameter extending from above roof to lowest floor, with chute intake doors at each floor and bottom of chute discharge door into designated room as indicated on drawings; comply with requirements of NFPA 82 and authorities having jurisdiction (AHJ).
 - 1. Chute Inside Diameter: 24 inches, minimum.
 - 2. Intake Doors: Bottom-hinged, self-closing and self-latching, with no locks.
 - 3. Intake Door Size: 15 inches wide by 18 inches high, nominal.
 - 4. Intake Door Operator: Latch handle that unlatches and opens door.
 - a. Locate highest component used for door operation lower than 48 inches above finished floor.
 - b. Provide latch handle with shape that is easy to grasp with one hand, does not require tight grasping or pinching, or twisting of wrist to operate.
 - 5. Provide manual controls in discharge room to activate spray cleaning equipment inside trash chute.

2.3 COMPONENTS

- A. Chute: Factory-fabricated to the greatest extent possible, with continuously welded or lock-seamed joints and smooth, nonsnag interior; no protruding bolts, rivets, or hardware and no sharp edges or corners.
 - 1. Sheet Metal Thickness: 16 gauge, 0.06 inch.
 - 2. Fire Rating: In compliance with local building code requirements.
 - 3. Chute Offsets: At maximum of 15 degrees and limited to one offset per two floors in accordance with NFPA 82.
 - 4. Throat Sections: Provide sloped throat sections for chute intake doors, of same material and construction as chute.
 - 5. Fabricate with support frames at each floor with sound isolator pads and expansion joints in chute between each support point.

- a. Sound Isolator Pads: Provide manufacturer's standard; 1/4 inch top and bottom waffle design, oil resistant, neoprene with 3/8 inch close grained cork core
- B. Chute Intake Doors: Factory-assembled, UL (DIR) listed and labeled door and frame, with self- or automatic-closing and positive latching; frame designed for chase construction, and flush-mounted.
 - 1. Material: Stainless steel, brushed or satin finish.
 - 2. Fire Rating: In compliance with local building code requirements.
 - 3. Pulls: Provide single action door hardware that is operable without pinching or twisting; polished stainless steel finish.
 - 4. Signs: Provide markings on frame or face of door that indicates purpose of chute; use engravings, integral raised lettering, or other permanent notation markings.
- C. Chute Discharge Doors: Factory-assembled, UL (DIR) listed and labeled door and frame, with self- or automatic-closing and positive latching, upon activation of smoke detector or fusible link; style as required for facility chute configuration indicated.
 - 1. Material: Aluminum-coated steel.
 - 2. Fire Rating: In compliance with local building code requirements.
 - 3. Vertical Discharge Style: Horizontally closing accordion fire damper, spring-closed.
- D. Chute Access Doors: Provide same construction and fire rating as chute intake doors with locks; provide wherever equipment requiring maintenance is located inside chute, including sprinklers, plumbing, and electrical connections.
- E. Chute Intake and Access Door Locks: Mortise or rim cylinder locks keyed alike; key removable only when door is locked.
- F. Through-Wall Chute Intake Door: Provide matching intake door at first floor level, for access to bin.
- G. Roof Vent: Full diameter, extending at least 48 inches above roof level, with roof deck flange.
 - 1. Material: Manufacturer's standard.
 - 2. Provide counterflashing and clamping ring of nonferrous metal compatible with chute material; see Section 07 62 00.
 - 3. Top Unit: Screened vent.
 - 4. Roof Curb: Provide wood curb at chute roof vent; see Section 06 10 00.
- H. Fire Suppression Sprinklers: Comply with requirements of NFPA 82 and NFPA 13; provide 1/2 inch NPS sprinkler heads mounted inside chute intake throats at following locations:
 - 1. At or above top intake opening.
 - 2. At lowest intake opening.
 - 3. In buildings of more than two stories, at every other floor.
- I. Spray Cleaning Equipment:
 - 1. Flushing Spray Unit: Solenoid controlled 3/4-inch NPS spray head mounted above top intake door; see Section 22 10 05 for water piping connections and Section 26 05 83 for wiring connections.
- J. Electrical Controls: 110 VAC; see Section 26 05 83 for wiring connections.

2.4 FABRICATION

- A. Factory fabricate chute sections with fully welded vertical seams, and locate sleeve inside each lower section without bolts, clips, or other projections to inside of chute that could snag on materials; spiral shaped sections within chute are not permitted.
 - 1. Provide prepositioned support clips to ensure proper intake levels.
 - 2. Provide expansion joint in chute between support joints.
 - 3. Reinforce discharge offsets, where allowed, with 11-gauge, 0.090-inch thick aluminum sheet material at area of impact.
- B. Vent: Matching diameter aluminum chute vent, 12 gauge, 0.080 inch thick, and extending at least 48 inches above roof surface with aluminum hinged metal safety cap in accordance with NFPA 82.
- C. Standard Floor Frames: Corrosion resistant, industrial grade enamel painted, 1-1/2 by 1-1/2 by 3/16 inch thick steel angles.

PART 3 EXECUTION

3.1 EXAMINATION

3.2 INTERFACE WITH OTHER WORK

- A. Complete installation and testing of facility chutes and equipment prior to completion of enclosing construction.
- B. Ensure that sprinkler and spray cleaning devices are coordinated with size, location, and installation of related service utilities.
- C. Schedule installation of components to ensure that utility connections are provided in an orderly and expeditious manner.

3.3 INSTALLATION

- A. Install facility chutes and equipment in accordance with NFPA 82, requirements of local authorities having jurisdiction (AHJ), and manufacturer's instructions.
- B. Maintain fire-resistive capacity of enclosing walls.
- C. Install facility chute plumb and without offsets or obstructions that might prevent free fall of materials, except as indicated on drawings in compliance with requirements.
- D. Securely anchor chute components as required to withstand impact and weight of materials placed within chute.
- E. Install roof vent flange to roof deck prior to installation of roofing.
- F. Install counterflashing after roofing installation.
- G. Adjust doors and other operating components for smooth operation.

3.4 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Place bagged material of expected size in chute to verify free fall.
- C. Test facility chute components for proper operation.
 - 1. Operate doors, locks, and interlocks.
 - 2. Operate spray cleaning devices.
 - 3. Simulate fire conditions inside chute to verify sprinkler and detector operation.

END OF SECTION

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SECTION 21 05 00

COMMON WORK RESULTS FOR FIRE SUPPRESSION

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. Piping materials and installation instructions common to most piping systems.
 - 2. Mechanical sleeve seals.
 - 3. Sleeves.
 - 4. Escutcheons.
 - 5. Grout.
 - 6. Fire-suppression equipment and piping demolition.
 - 7. Equipment installation requirements common to equipment sections.
 - 8. Painting and finishing.
 - 9. Concrete bases.
 - 10. Supports and anchorages.

1.03 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
 - 1. CPVC: Chlorinated polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:
 - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.04 SUBMITTALS

- A. Product Data: For the following:
 - 1. Mechanical sleeve seals.
 - 2. Escutcheons.
- B. Welding certificates.

1.05 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Fire-Suppression Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.07 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for fire-suppression items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 21 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.03 JOINING MATERIALS

- A. Refer to individual Division 21 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements for Joining CPVC Plastic Piping: ASTM F 493.

2.04 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 3. Pressure Plates: Carbon steel. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.05 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.06 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated and rough brass.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated and rough brass.

E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.07 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 21 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.

- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
 - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.
 - h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
 - i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed hinge and set screw or spring clips.
 - j. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
 - k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips.
 - l. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
 - 2. Existing Piping: Use the following:
 - a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
 - b. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and spring clips.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
 - g. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with rough-brass finish.
 - h. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips.
 - i. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
 - j. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
 - k. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
- M. Sleeves are not required for core-drilled holes.

- N. Permanent sleeves are not required for holes formed by removable PE sleeves.
- O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- P. Install sleeves or other methods approved by engineer prior to installation for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - 3. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
 - b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
 - 1) Seal space outside of sleeve fittings with grout.
 - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
 - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- T. Verify final equipment locations for roughing-in.

- U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.02 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 21 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

3.03 PAINTING

- A. Painting of fire-suppression systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.04 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.05 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.06 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor fire-suppression materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.07 GROUTING

- A. Mix and install grout for fire-suppression equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.

- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION

SECTION 21 10 00

AUTOMATIC SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Extent of Automatic Sprinkler Fire Extinguishing System Work required by this section is indicated on Drawings, by requirements of this section and as required.
- B. This section includes design and provisions of an Automatic Sprinkler Fire Extinguishing System. Types of Fire Extinguishing Automatic Sprinkler Systems specified in this section include the following:
 - 1. Wet Pipe System

1.2 REFERENCES

- A. NFPA 13R - Installation of Sprinkler Systems.

1.3 DESIGN CRITERIA

- A. System to provide coverage for entire building.
- B. Interface system with building fire and smoke alarm system.
- C. Design systems to the occupancy requirements of NFPA 13R, and the Owners Insurance Underwriter if more stringent.
- D. Provide fire department connection.
- E. Provide detailed shop drawings of the automatic sprinkler systems in accordance with NFPA 13R.
- F. Provide hydraulic calculations of the automatic sprinkler systems in accordance with NFPA 13R. Hydraulic calculations shall not exceed 90 percent of the available pressure.

1.4 QUALITY ASSURANCE

- A. Conformance with applicable state and local codes and ordinances.
- B. Equipment and Components: Bear FM label or marking.
- C. Specialist Firm: Company specializing in sprinkler systems design and installation, Licensed Fire Protection Contractor by the Department of Insurance with minimum three years experience.

1.5 REGULATORY REQUIREMENTS

- A. Design and install in accordance with NFPA 13, and the requirements of Owner's Insurance Underwriter or Insurance Service Office, if more stringent.

- B. Pipe sizes as shown on the drawings are minimum pipe sizes. Contractor shall increase those pipe sizes if calculations so require at no additional cost, but under no circumstance shall pipe sizes be decreased.
- C. Contractor to supply a complete sprinkler package not limited to the items included in this specification.
- D. Sprinkler contractor to design and provide an automatic sprinkler system in accordance with the NFPA 13R and as required
- E. Sprinkler contractor to hydraulically calculate the system based on the results of an on site flow test. The calculations to be based on ordinary hazard occupancy.
- F. Where applicable conceal all piping above ceilings, in walls or chases as needed and install semi recessed pendant head. All piping to be installed as high as possible above the ceiling. Provide drains, inspector test stations, flow and tamper switches and pipe supports as required by the system and NFPA. The sprinkler system and the related component will match the existing systems within the existing building as to the materials used. Contractor to verify the acceptable location of each inspector test station with the owner prior to installation, if drain is routed to outside it will be terminated on a splash block to prevent erosion.

1.6 SUBMITTALS

- A. Prior to submittal to Architect/Engineer submit shop drawings, product data, and hydraulic calculations to local Fire Marshal and/or Owner's Insurance Underwriter or Insurance Services Office for approval. Contractor shall be responsible for all costs for approval process.
- B. After approval from local Fire Marshal and Owner's Insurance Underwriter or Insurance Services Office submit shop drawings, product data and hydraulic calculations to Architect/Engineer (with Certificate of Approval from local Fire Marshal and Owner's Insurance Underwriter or Insurance Services Office) for approval in accordance with Division 01.
- C. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, components and accessories.
- D. Submit certificates as listed below to Architect/Engineer in accordance with Division 01.
 - 1. Test Certificate of Approval for equipment and system operation.

1.7 PROJECT RECORD DOCUMENTS

- A. Submit documents in accordance with Division 01.

1.8 OPERATION AND MAINTENANCE DATA

- A. Submit manufacturer's operation and maintenance data under provisions of Division 01.
- B. Include written maintenance data on components of system, servicing requirements, and Record Drawings.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store equipment in shipping containers with labeling in place under provisions of Division 01.

1.10 EXTRA STOCK

- A. Provide extra sprinkler heads under provisions of NFPA 13R.
- B. Provide suitable wrenches for each head type.
- C. Provide metal storage sprinkler head and wrench cabinet in location designated.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. See Fire Protection Piping section.

2.2 ALARM CHECK VALVE

- A. Alarm Check Valve: Automatic flow detector with alarm circuits, pressure switch, retard chamber, and water motor alarm gong.

2.3 DRY-PIPE VALVE

- A. Dry-pipe valve: Valves shall be equipped to give a local low-air pressure signal at 65 percent of the normal air pressure carried in the system. Valves shall be provided with standard trimming, including priming connection, water- and air-pressure gauges, pressure switches, priming water-level test facilities, alarm testing bypass, accelerator, and all necessary pipe, fittings, and accessories required to provide a complete installation.

2.4 AIR SUPPLY SYSTEM

- A. Air supply systems for dry pipe system shall be provided from new air compressor.
- B. Air Compressor: Single-stage air-cooled type, designed to maintain the required pressure on the system. Motor shall be capable of operating the compressor at rated capacity continuously without exceeding the nameplate rating and shall be provided with thermal-overload protection. Motor control shall be provided with an adjustable pressure switch to automatically start and stop the motor at required.
- C. Drum Drips: Drum drips shall be installed in accordance with NFPA 13R. The installation shall be so made that the sprinkler system is not impaired while condensate is being removed from the piping.

2.5 FIRE DEPARTMENT CONNECTIONS

- A. Fire Department Connection (FDC): Cast brass body, rough chrome-plated brass finish, two-way wall type, and 2-1/2 "X 4" with polished chrome-plated brass swivels. Fire department connection shall be

provided with polished chrome-plated brass plugs, chains, 18 inch sleeve and round plate lettered "Auto-Sprk". Threading on inlets of fire department connection shall be same as Municipal Fire Department threads.

2.6 SPRINKLER HEADS

- A. Suspended Ceiling Type:
1. Semi-recessed "Standard" pendent type with chrome-plated finish and matching escutcheon.
 2. For dry-pipe system installations, provide "dry" pendent type as specified above.
 3. In all electrical rooms provide institutional vandal resistant pendant type sprinkler heads with nickel-plated conical escutcheon.
- B. Exposed Area Type: Standard upright type with chrome finish.
- C. Fusible Link: Temperature rated for specific area hazard.
- D. Guards: Finish to match sprinkler head.

2.7 ELECTRIC SWITCHES

- A. Alarm switch:
1. Vane type, 24 VDC, adjustable retard (wet system only).
 2. Pressure Type, Snap Action, NEMA 4 construction, 5 psi to 15-psi adjustment range, 24 VDC (dry system only). Designed to activate alarm on increase in pressure.
- B. Supervisory switch:
1. OS&Y gate valve type, 24 VDC.
 2. Pressure switch: 24 VDC.

2.8 ALARM BELL

- A. Exterior Alarm Bell: Electric 10" diameter, weatherproof, 97 dB at 10'-0", 24 VDC, marked "Sprinkler Alarm".
- B. Interior Alarm Bell: Electric 6" diameter, 93 dB at 10'-0", 24 VDC, marked sprinkler alarm.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate Work of this Section with other affected work.

3.2 INSTALLATION

- A. Installation shall be in accordance with NFPA 13R.
- B. Locate fire department connection in accordance with authority having jurisdiction. With sufficient clearance from walls, obstructions, or adjacent Siamese connectors to allow full swing of fire department wrench handles.
- C. Locate exterior alarm bell on outside building wall next to riser.
- D. Place pipe runs to minimize obstruction to other work.
- E. Place piping in concealed spaces above finished ceilings.
- F. Center heads in two directions in 2' -0" "X 2' -0" ceiling tile and provide piping offsets as required.
- G. Apply strippable tape or paper cover to ensure sprinkler heads do not receive field paint finish.
- H. Provide excavation, bedding, backfilling and compaction in accordance with Section 15018 for work in this section.
- I. Provide 3/4-inch ball drip at low point of fire department connection and pipe to floor drain or through exterior wall. Provide one cubic foot of 3/4-inch washed rock around ball drip.
- J. Dry sprinkler systems located in areas with ceilings shall be concealed with dry pendent type sprinkler heads.

3.3 SYSTEM TESTS

- A. Test dry pipe system, wet pipe system, alarm switches, supervisory switches, water motor gongs or electric alarm bells, and interfacing with building fire and smoke alarm system to ensure proper operation. Tests shall be performed in accordance with the City Fire Marshal, Insurance Office Services and NFPA 13R.
- B. Tests shall be witnessed and approved by local Fire Marshal and Architect/Engineer.
- C. After completion and approval of testing submit "Test Certificate of Approval" for dry pipe system, wet pipe system, alarm switches, supervisory switches, water motor gongs or electric alarm bells stating that all test results are satisfactory. Contractor, local Fire Marshal, Owner's Insurance Underwriter, Insurance Office Services and Architect/Engineer must sign certificate of Approval.

3.4 DEMONSTRATION OF SYSTEM AND EQUIPMENT

- A. Prior to final acceptance, Contractor shall provide a minimum of 4 hours (or as long as required by the Owner) to demonstrate to the Owner the proper operation of the automatic sprinkler system including associated accessories and controls.
- B. After completion and approval of demonstrations, submit "Demonstration Certificates of Completion" for automatic sprinkler system including all associated accessories and controls stating that the

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Demonstrations of the systems are satisfactory. The manufacturer's Representative, Contractor,
Owner and Architect/Engineer must sign certificates.

END OF SECTION

SECTION 21 11 00
FIRE PROTECTION PIPING

PART 1-GENERAL

1.1 SUMMARY

- A. Extent of Fire Protection Piping Work required by this section is indicated on drawings, by requirements of this section and as required.
- B. This section includes pipe, fittings and valves for Fire Protection Systems. Types of Fire Protection Piping Systems specified in this section include the following:
 - 1. Automatic Sprinkler Systems.

1.2 REFERENCES

- A. ANSI/ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
- B. ANSI/ASME B16.3 - Malleable Iron Thread Fittings, Class 150 and 300.
- C. ANSI/ASME B16.4 - Cast Iron Threaded Fittings, Class 125 and 250.
- D. ANSI/ASME B16.5 - Pipe Flanges and Flanged Fittings.
- E. ANSI/ASME B16.9 - Factory-made Wrought Steel Butt welding Fittings.
- F. ANSI/ASME B16.11 - Forged Steel Fittings, Socket-welded and Threaded.
- G. ANSI/ASME B16.18 - Cast Copper Alloy Solder-Joint Pressure Fittings.
- H. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- I. ANSI/ASME B16.25 - Buttwelding Ends.
- J. ANSI/ASME B36.10 - Welded and Seamless Wrought Steel Pipe.
- K. ANSI/ASME Section 9 - Welding and Brazing Qualifications.
- L. ANSI/ASTM A135 - Electric-Resistance-Welded Steel Pipe.
- M. ANSI/ASTM A47 - Malleable Iron Castings.
- N. ANSI/ASTM B32 - Solder Metal.
- O. ANSI/AWS A5.8 - Brazing Filler Metal.
- P. ANSI/AWWA C110 - Ductile Iron and Gray Iron Fittings.
- Q. ANSI/AWWA C151 - Ductile Iron Pipe, Centrifugal Cast.

- R. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless.
- S. ASTM A795 - Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.
- T. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
- U. ASTM B75 - Seamless Copper Tube.
- V. ASTM B88 - Seamless Copper Water Tube.
- W. ASTM B251 - General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
- X. AWS D10.9 - Specifications for Qualification of Welding Procedures and Welders for Piping and Tubing.
- Y. NFPA 13RR - Installation of Sprinkler Systems.
- Z. NFPA 24 - Private Fire Service Mains and their Appurtenances.

1.3 QUALITY ASSURANCE

- A. Conformance with applicable state and local codes and ordinances.
- B. Welding Materials and Procedures: Conform to ASTM Code.
- C. Employ certified welders in accordance with ANSI/ASME Section 9.
- D. Valves: Bear FM label or marking. Provide manufacturer's name and pressure rating marked on valve body.
- E. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

1.4 REGULATORY REQUIREMENTS

- A. Install in accordance with NFPA 13R and the requirements of Owner's Insurance Underwriter or Insurance Services Office.
- B. Piping materials specified herein are acceptable products to the Architect/Engineer but all are not necessarily acceptable to applicable local codes or ordinances. It is the responsibility of the Contractor to provide materials, from the options listed herein, that are acceptable to both the Architect/Engineer and applicable local codes and ordinances.
- C. Pipe sizes as shown on the drawings are minimum pipe sizes. Contractor shall increase those pipe sizes if calculations so require, but under no circumstance shall pipe sizes be decreased.

1.5 SUBMITTALS

- A. Prior to submittal to Architect/Engineer submit shop drawings, product data, and hydraulic calculations to local Fire Marshal and Owner's Insurance Underwriter or Insurance Services Office for approval.
- B. After approval from local Fire Marshal and Owner's Insurance Underwriter or Insurance Services Office, submit shop drawings, product data, and hydraulic calculation to Architect/Engineer (with Certificate of Approval from local Fire Marshall and Owner's Insurance Underwriter or Insurance Services Office) for approval in accordance with Division 01.
- C. Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals.
- D. Indicate valve data and ratings.
- E. Submit certificates as listed below to Architect/Engineer in accordance with Division 01.
 - 1. Test Certificate of Approval for Piping System.

PART 2 - PRODUCTS

2.1 PIPE, FITTINGS, AND VALVES

- A. All exterior below ground piping shall be ductile iron pipe (AWWA C151). Fittings shall be ductile iron, 250 pound rated, mechanical joint (AWWA C110). Joints shall be mechanical joint or push-on (AWWA C111). Both pipe and fittings shall be tar coated outside and cement-mortar lined inside (AWWA C104).
- B. System design pressure is 175 psig.
- C. Provide piping and valve identification in accordance with other sections.

2.2 PRESSURE REDUCING VALVE

- A. Pressure reducing valve shall maintain a constant downstream pressure regardless of fluctuations in demand and/or inlet pressure. It shall be a hydraulically operated, pilot controlled, diaphragm type globe valve.
- B. The main valve shall have a single removable seat and a resilient disc with a rectangular cross-section which shall be retained on three and one-half sides to assure that the disc will be held firmly in place under such high differential pressure conditions that may develop across the seating area. No "O" ring type disc will be permitted. The stem shall be guided at both ends by a bearing in the valve cover and an integral bearing in the sufficient diameter to withstand high hydraulic pressures, also it must be drilled and tapped in the cover end to receive and affix such accessories as may be necessary. There shall be no external packing glands permitted nor are pistons allowed in the main valve or pilot control system. The control system shall include a fixed orifice and all major components of this system shall be manufactured by the same company that manufactures the main valve. All elastomer shall be Buna-N and the main valve diaphragm shall be vulcanized at the stem hold to insure against wicking failure. The diaphragm shall not be used as the seating surface. All necessary repairs and/or modifications other than the replacement of the main valve body shall be possible without removing the main valve from the line.
- C. The pilot control shall be a direct acting adjustable, spring loaded, normally open diaphragm valve, designed to permit flow when controlled pressure is less than the spring setting.

- D. The main valve materials shall be cast steel body with brass and bronze trim. The pilot system shall be cast brass with 303 stainless steel trim. Flange ratings shall be 300 lb. class rated for 300 psi maximum working pressure. Valve shall have internal epoxy coating applied to all wetted surfaces by the fused method process to an average thickness of 12 mils.
- E. This valve shall be UL listed - Special System Water Control Valves - Class II Guide VLMT - File No. EX2354 and File No. EX2855, C.C. No.HNFX.
- F. A direct factory representative shall provide start up service, inspection or necessary adjustments.

2.3 EXCAVATION, BACKFILLING AND COMPACTING

- A. Provide excavation, backfilling and compacting in accordance with other sections.

2.4 PIPING SPECIALTIES

- A. Provide piping specialties in accordance with other sections.

2.5 SUPPORTS AND ANCHORS

- A. Provide supports and anchors in accordance with other sections.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Ream pipe and tube ends to full inside diameter.
- B. Remove burrs and bevel plain end ferrous pipe.
- C. Remove scale and foreign material, inside and outside, before assembly.

3.2 INSTALLATION - PIPE

- A. Thread steel pipe joints up to and including 1-1/2 inch diameter. Thread, weld, or groove 2-inch diameter and larger, including branch connections.
- B. Mechanical Joints may be used instead of threaded or welded joints.
- C. 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.
- D. Coast threaded ends with pipe lubricant compound.
- E. In steel piping, main sized saddle branch connections or direct connection of branch lines to mains is permitted if main is two pipe sizes larger than the branch. Do not project branch pipes inside the main pipe.

- F. Solder or braze copper tubes.
- G. Install piping in accordance with NFPA 13R, for sprinkler systems.
- H. Do not penetrate or cut building structural members.
- I. Provide sleeves when penetrating floors and walls in accordance with other sections.
- J. Seal pipe and sleeve penetration to achieve fire and smoke resistance equivalent to fire and smoke separation required in accordance with other sections.
- K. Excavation, bedding, backfilling and compacting for below ground piping in this section is specified in other sections.
- L. Fire protection water service piping below building shall be provided with both flanged joints and thrust block restraint in accordance with NFPA 24. Flange bolts and nuts shall be stainless steel. Thrust block restraint shall be provided on the below floor elbow at the base of the riser. Area of bearing face of concrete thrust block shall be a minimum of 32 square feet.
- M. Establish elevation of buried pipe outside the building to ensure not less than 3 feet of cover over top of pipe..

3.3 INSTALLATION - VALVES

- A. Install valves with stems upright or horizontal, not inverted.
- B. Provide drain valves at main shut-off valve and after all zone valves. In addition, provide auxiliary drains at all low points.
- C. Adjust all pressure reducing valves to minimum pressures within the operating pressure range as required by NFPA 13R. Fire Department valve outlet shall not exceed 150 psig. Automatic sprinkler systems shall not exceed 100 psig.

3.4 CLEANING

- A. Flush entire piping system of foreign matter in accordance with NFPA 13R and NFPA 24.

3.5 TESTING

- A. Hydrostatic test entire system in accordance with local Fire Marshal, Owner's Insurance Underwriter, NFPA 13R and NFPA 24 or 1-1/2 times the operating pressure, whichever is greater.
- B. Test results shall be witnessed and approved by local Fire Marshal and Architect/Engineer, or Owner's Representative.
- C. Submit Test Certificate of Approval for Piping System stating that all test results are satisfactory. Certificate of Approval must be signed by Contractor, local Fire Marshal, Owner's Insurance Underwriter, and Architect/Engineer.

END OF SECTION

SECTION 22 05 00

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PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division 1 Specification sections, apply to work of all Division 22 sections.

1.02 DESCRIPTION OF WORK

- A. The base bid shall include furnishing all materials, labor, tools, equipment and installation of all work required to install complete Plumbing systems as outlined in Division 22.
- B. Unless specifically described otherwise, the Contractor responsible for installing the work inside the building shall extend all Plumbing utilities from a point 5'-0" outside the building.
- C. The Contractor shall examine the Drawings and Specifications and visit the site prior to submitting his bid.

1.03 SUMMARY

- A. This Section includes the following:
 - 1. Manufacturers.
 - 2. Product Delivery, Storage, and Handling.
 - 3. Substitutions and Equipment Selection.
 - 4. Valve Tags.
 - 5. Firestopping and Smoke-stopping.
 - 6. Joining materials.
 - 7. Dielectric fittings.
 - 8. Mechanical sleeve seals.
 - 9. Sleeves.
 - 10. Escutcheons.
 - 11. Grout.
 - 12. Metal framing systems.
 - 13. Fastener systems.
 - 14. Equipment supports.
 - 15. Equipment Nameplates.
 - 16. Mechanical demolition.
 - 17. Piping Systems – Common requirements.
 - 18. Concrete bases.
 - 19. Temporary Services
 - 20. Excavation and Backfilling
 - 21. Controlled Low Strength Material (Flowable Backfill)
 - 22. Cleaning Premises
 - 23. Painting, Marking, and Nameplate Data

1.04 QUALITY ASSURANCE

- A. General: Refer to Division 1 Sections for general administrative/procedural requirements related to compliance with codes and standards.
- B. Application: It is a general requirement that Plumbing work comply with applicable requirements and recommendations of standards published by listed agencies and trade associations, except to extent more detailed and stringent requirements are indicated or required by governing regulations.
- C. Listing of Associations, Standards and Abbreviations Specific to Plumbing Work (in addition to standards specified in individual work sections), conform to following applicable standards (edition in force, complete with all interim agreements and local amendments in effect):
 - 1. AGA - American Gas Association
 - 2. AHJ - Authority Having Jurisdiction
 - 3. ANSI - American National Standards Institute
 - 4. ASME - American Society of Mechanical Engineers
 - 5. ASPE - American Society of Plumbing Engineers
 - 6. ASSE - American Society of Sanitary Engineering
 - 7. ASTM - American Society for Testing Materials
 - 8. AWS - American Welding Society, Inc.
 - 9. AWWA - American Water Works Association, Inc.
 - 10. CAGI - Compressed Air and Gas Institute
 - 11. CISPI - Cast Iron Soil Pipe Institute
 - 12. EPA - Environmental Protection Agency
 - 13. FM - FM Global
 - 14. NIST - National Institute for Standards and Technology
 - 15. NEC - National Electrical Code by NFPA
 - 16. NFPA - National Fire Protection Association
 - 17. NSF - National Sanitation Foundation
 - 18. OSHA - Occupational Safety and Health Administration (US Department of Labor)
 - 19. PDI - Plumbing and Drainage Institute
 - 20. UL - Underwriters' Laboratories, Inc.
 - 21. Plumbing Code
 - 22. Other applicable codes, requirements, rules or regulations of bodies lawfully empowered and having jurisdiction over this project.

1.05 SUBMITTALS

- A. General: Refer to Division 1 for general requirements concerning submittals.
- B. Unless otherwise specified and in addition to provisions of the General Conditions, submit drawings having each sheet and each page of a brochure, marked with identification and containing information described below. Submittals are to be complete, legible and in English; partial submittals will not be accepted or reviewed and may be returned or discarded at the discretion of the Engineer.
- C. Identification:
 - 1. Include project name and Architect's job number. If pages are securely bound in a brochure, this is required on the cover only.

2. Identification by the particular specification section and article under which equipment or material is described.
3. The fixture/equipment designation as it appears on the Drawings (placed in the upper right-hand corner of the submittal).
4. When more than one (1) item of equipment is covered by a single drawing or specification sheet, each project equipment item must be separately identified thereon with clear delineation as to which model or catalog number or performance data applied to each project item.

D. Information:

1. Manufacturers' specification sheets of every component being provided with all items (including, but not limited to, manufacturer, model number, dimensional information, performance criteria and electrical/fuel requirements) clearly highlighted.
2. Provide complete installation drawings of the equipment detailing all field connection points for all related trades.
3. Dimensions including weights and capacities.
4. Wiring diagrams showing control interfaces as applicable.
5. Pressure drops as applicable.
6. Required clearances for installation and maintenance.
7. Warranty sheets.
8. Welding certificates.

1.06 SUBSTITUTIONS

- A. If the Contractor proposes substitutions of any fixture or equipment specified herein on the Drawings, it shall be the Contractor's responsibility to obtain approval for such fixture or equipment from the Engineer. By making such a proposal, it is deemed that the Contractor shall bear any and all costs of any change necessary to accommodate the substitution(s).
- B. The Contractor shall coordinate the installation of an approved substitute, make such changes as may be required for the work to be completed and be made compatible with other systems in all respects.
- C. If substitutions of controls or equipment requires any changes in the structural design and/or electrical work from that shown on the Drawings, the extra cost of the equipment, added structural and/or electrical work shall be the responsibility of the Contractor.
- D. Product data for proposed substitutions:
 1. Submit 4 copies of complete data, with drawings, manufacturer specification sheet(s) and samples (if requested by the Engineer), with all verbiage and units of measure in English, including:
 - a. Manufacturer(s), model number(s) and fixture/equipment designation as it appears on the Drawings and/or Specifications (placed in the upper right-hand corner) of the design base and proposed substitution products.
 - b. Comparison of the qualities of the proposed substitution will be specified.
 - c. Changes required in other elements of the work because of the substitution.
 - d. Impact on construction schedule.
 - e. Cost data comparing the proposed substitution with the product specified (including cost impact on related work of other trades).
 - f. Availability of maintenance service and source(s) of replacement materials.

- g. Any requests for equipment substitution shall include 1/4-scale layouts of proposed equipment in plan, elevations and sections complete with all piping connections as applicable to verify fit within allocated spaces, service and maintenance clearances and equipment replacement access spaces.
- E. Incomplete proposed substitution submittals will not be reviewed or considered and will be returned or discarded at the Engineer's discretion. The acceptance of substitutions is entirely at the discretion of the Engineer.

1.07 PERMITS AND FEES

- A. Obtain all permits, licenses, certificates of inspections and testing reports that are required of this work by all laws, ordinances, rules and regulations or orders of any Authority Having Jurisdiction. The Contractor shall pay all fees, schedule all inspections and tests and issue all notifications as required and related to his work. No work shall be covered before inspection by the Authority Having Jurisdiction and observation by the Engineer.
- B. Laws, ordinances, rules and regulations which bear upon or affect the various branches of this work shall be complied with, and are hereby made a part of this contract.
- C. All work which laws require to be inspected shall be submitted to the proper Authority Having Jurisdiction for inspections and certificates of final approval must be furnished to the Owner before final acceptance will be given by the Engineer.

1.08 EXPLANATION AND PRECEDENCE OF DRAWINGS AND SPECIFICATIONS

- A. Prior to submitting his bid, the Contractor shall review all Drawings and Specifications to determine any conflict with all applicable local codes, rules or regulations. The Contractor shall obtain clarification of such during bidding.
- B. When the work as indicated on the Drawings and/or Specifications exceeds the minimum required by any code, standard, rule or regulation, the Drawings and/or Specifications shall govern the design and installation of the work.
- C. For purposes of clarity and legibility, the Drawings are essentially diagrammatic although size and location of equipment are drawn to scale wherever possible. The Contractor shall make use of and verify all information on the Drawings and Specifications.
- D. The Contractor shall fully inform himself regarding any and all peculiarities and limitations of the spaces available for the installation of all work and materials furnish and installed under this Contract. He shall exercise due and particular caution to determine that all parts of his work are made readily accessible.
- E. The Drawings indicate required sizes and points of termination of piping and suggests proper routes to conform to structure, avoid obstructions and preserve clearances. However, it is not intended that the Drawings indicate all necessary offsets, and it shall be the work of the Contractor to make the installation in such a manner as to conform to the structure, avoid obstructions, preserve headroom, keep openings and passageways clear and maintain required service clearances without additional cost to the Owner.
- F. Significant changes by the Contractor in design, sizing and/or location of system piping, fixtures and/or equipment as shown on the Drawings are prohibited without prior written approval by the Owner. Should the Contractor fail to obtain the Owner's written approval and proceed to make these unauthorized changes, he does so at the risk of accepting total responsibility and related

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costs therein for the design elements he may alter.

- G. It is intended that all plumbing devices, piping, etc. be located symmetrically with all Architectural elements. Refer to the Drawings and Specifications of all disciplines in completing the required co-ordination.
- H. Where the Drawings and/or Specifications are in conflict, obtain clarification of such during bidding. Official clarification will only be given in written form. Any clarification issued by other than written form will not be considered official and shall be non-binding for work under this Contract. Where clarification cannot be delivered in a timely manner, the Contractor shall base his bid on the greater quantities, higher standards or more restrictive requirements. In the event of discrepancies in the Drawings and/or Specifications after the bid period, the Contractor shall advise the Architect and Engineer of such prior to proceeding with the work in question in order that correct progress of the work may be insured.
- I. Prior to submitting his bid, the Contractor shall review all Drawings and Specifications to determine any conflict with all applicable local codes, rules or regulations. The Contractor shall obtain clarification of such during bidding as outlined above.
- J. The submittal of his bid shall indicate the Contractor has examined the site; all applicable local codes, rules and regulations; the Drawings and Specifications and has included all required allowances in his bid. No allowance shall be made for any error or omission resulting from the Contractor's failure to visit the job site and/or review the Drawings and Specifications. The Contractor's bid shall include costs for all required drawings and changes as outlined above at no additional cost to the Owner.

1.09 SUPERVISION AND WORKMANSHIP

- A. Workmanship throughout shall conform to the standards of best practice and all labor employed must be competent to do all the work required.
- B. Furnish the services of an experienced superintendent to be in constant charge of the work at all times.
- C. Quality Assurances: If requested demonstrate the ability to perform all work to be included under the contract. Assurance if requested, shall be in the form of a list of past projects of similar size and complexity and a list of six (6) references pertaining to those projects. Failure to demonstrate these quality assurances shall be taken as a statement of inability to perform.
- D. A minimum five (5) years of experience in the installation of plumbing systems similar to the systems specified is required.
- E. Inspection: Provisions shall be made for Owner's representative to make rough-in and open ceiling inspections prior to covering up work.

1.10 LOCATIONS AND INSPECTION OF SITE

- A. The Contractor shall fully familiarize himself regarding any and all peculiarities and limitations of the spaces available for the installation of all work and materials furnished and installed under this Contract. Coordinate with all other trades in advance of the work, requirements for openings, recesses and chases in the walls, partitions, equipment housekeeping pads, framing or openings, requirements for servicing equipment and routing of piping relative to each trade to alleviate conflicts. Should furnishing this information be neglected, delayed or incorrect and additional cutting is required, the cost of it shall be borne by the Contractor. Nothing in this paragraph shall be construed to relieve the Contractor of the responsibility for providing and paying for the required core drillings and openings in existing work.

B. Diagrammatic indications on the Drawings are:

1. Approximate only.
2. Shown distorted at various locations.
3. Possibly moved for visual clarity.

C. Exact locations shall:

1. Be required for proper installation in available space.
2. Be as required to preserve the required space for the servicing of equipment and components.
3. Avoid interference with Architectural and Structural features and the work of all other trades.
4. Be coordinated with the work of all other trades toward the general purpose of having the work progress rapidly and smoothly with a minimum interference between one trade and another.
5. Preserve headroom and keep openings and passageways clear.
6. Conceal all piping above ceilings, in walls, pipe shafts, pipe spaces and furring whenever possible.

D. Include a neat, orderly arrangement of piping symmetrical to building lines, light and tile patterns and other building elements. Any deviations not shown on the Drawings shall be requested in writing prior to implementation.

1.11 PERFORMANCE QUALIFICATIONS

- A. Installer's Qualifications: Firm with at least five (5) years of successful installation experience on projects with work similar to this project and meet applicable regulatory agencies requirements.
- B. Compatibility: Provide products which are compatible with other products of the mechanical work and with other work requiring interface with the mechanical work. Provide products with the proper or correct power characteristics, fuel-burning characteristics and similar adaptations for this project. Coordinate the selections from among options (if any) for compatibility of products.
- C. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.
- D. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- E. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- F. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.12 PERFORMANCE REQUIREMENTS

- A. Examine all Mechanical, Electrical, Architectural, Site and Structural Drawings, and available soil reports. Visit site and become acquainted with all conditions which may affect execution of work.

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- B. Provide all work in accordance with State and Local Codes, Regulations and/or Ordinances, and meet approval of authorities having jurisdiction. Provide only new material and as specified.
- C. Furnish to the Owner, with a copy to the Architect, a Certificate of Final Approval from governing authority prior to the Owner's final acceptance, where applicable.
- D. General Outline: The facilities and systems of the mechanical work include all Division 22 Sections.
- E. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- F. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.13 COORDINATION OF PLUMBING WORK

- A. Refer to Division 1 Sections for general coordination requirements applicable to entire work. The Contract Documents are diagrammatic in showing certain physical relationships which must be established within mechanical work, and in its interface with other work, including utilities, control and electrical work.
- B. The Contractor shall fully participate in all coordination sessions with other trades as they may be scheduled by the Owner, Construction Manager or Architect.
- C. Arrange plumbing work in a neat, well organized manner, with piping and similar services running parallel with primary lines of the building.
- D. Give right-of-way to piping which may slope for drainage.
- E. Locate operating and control equipment properly to provide easy access, and arrange entire plumbing work with adequate access for operation and maintenance.
- F. Advise other trades of openings required in their work for the subsequent move-in of large units of plumbing work (equipment).
- G. Strictly adhere to invert elevations for all underground piping. Pitch piping evenly between pipe junctions and where indicated on the drawings. Piping, not installed at invert elevations indicated on the drawings, shall be removed and re-laid.

1.14 CUTTING AND PATCHING

- A. Perform all cutting and patching required for work of this section in rough construction of the building.
- B. All patching of finished construction shall be performed under the sections of the Specifications covering these materials and at no additional cost to the Owner.
- C. All cutting of concrete work by the Contractor shall be by core drilling or concrete saws with dust collection systems. No cutting or coring of structural members shall be done without first obtaining the permission of the Owner. All cuts by the Contractor shall be plumb, square and true.
- D. Core Drilling: Use core drills rather than percussion type equipment for making holes in concrete. All percussion type drilling including hammer drills must be scheduled through the Owner.

- E. All patching of existing, adjacent surfaces shall match existing material and finish in a manner satisfactory to the Architect.

1.15 DAMAGE BY LEAKAGE

- A. The Contractor shall be responsible for damage to the grounds, walks, roads, buildings (including walls, floors and ceilings), piping systems, mechanical and electrical systems (and their related equipment and contents) caused by leakage in the piping systems being installed or having been in-
- B. -stalled herein. The Contractor shall repair all damage caused at no additional cost to the Owner. All repair work shall be performed as directed by the Owner.

1.16 EMERGENCY REPAIRS

- A. The Owner reserves the right to make emergency repairs as may be required to keep equipment in operation without voiding the Contractor's guarantee bond or relieving the Contractor of his responsibilities.

1.17 RECORD DRAWINGS

- A. Provide and maintain on the work site 1 complete set of Record Drawings for the Division 22 work. Carefully record on this set of drawings all work including fixtures, equipment, piping, fittings, components, etc which is installed differently from that indicated on the Drawings; locate dimensionally from fixed points all buried piping including depths relative to finish floor or finish grade elevations as applicable. The depth shall also be indicated for all plugged wyes, tees and capped lines. Mark all changes of location of piping, fixtures and equipment in accordance with Division 1 Sections.
- B. All existing lines discovered shall be indicated on these Drawings and located dimensionally from fixed points along with depths, if buried.
- C. The Record Drawings shall be continuously kept up-to-date and shall be available for inspection anytime during normal working hours.
- D. At completion of the work, provide a neat and legible reproducible set of the Record Drawings, which shall be individually signed and dated by the Contractor and Project Supervisor as to their accuracy.
- E. Such drawings shall be submitted to for acceptance and approval to the Owner before a final certificate of acceptance will be issued.

1.18 ELECTRONIC FILES

- A. Drawings for this project were prepared using AutoCAD software. Electronic files are available upon request for use by the successful contractor(s) for planning, coordination and installation.
- B. There will be no charge for drawing files that were prepared using AutoCAD. These files will be available only in the version in which they were created.
- C. The Request Drawings form can be obtained from the Engineer's office, completed and submitted to his attention.

1.19 WARRANTY

- A. Provide a guarantee in written form stating that all work under this section shall be free of defective work, materials, or parts for a period of one year from the date of substantial completion, Owner's final acceptance and shall repair, revise or replace at no cost to the Owner any such defects occurring within the guarantee period. State in written form that any items or occurrences arising during the guarantee period will be attended to in a timely manner and will in no case exceed four (4) working days from date of notification by the Owner.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Firms regularly engaged in the manufacture of products of quality, types and sizes required; and which have been in satisfactory use of not less than four (4) years in similar service, except as otherwise noted in specific sections of this division.

2.02 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Protect products against dirt, water, chemical and mechanical damage. Do not install damaged products.
- B. Deliver products to site in factory fabricated containers, with the manufacturer's label clearly visible. Handle carefully to avoid damage to components, enclosure and finish, and in strict accordance with manufacturer's instructions.
- C. Store products in clean dry place in original containers, protected from weather and construction traffic. If the new structure is not weathered in, the contractor will provide portable storage trailers to protect material that can be damaged by the weather.
- D. The contractor shall be responsible for all security related to theft and vandalism for stored materials. Failure to adequately protect equipment that is damaged will not be cause for delay claims or additional compensation by the Owner.

2.03 PIPE LABELING

- A. Pipe labels shall be as follows:
 - 1. Semi-rigid colored vinyl pre-coiled plastic pipe markers with directional arrows:
 - a. Piping 2-3/8" O.D. (including insulation) and smaller shall be 15 gauge.
 - b. Piping larger than 2-3/8" O.D. (including insulation) shall be 30 gauge.
 - c. Piping 6-1/8" and larger (including insulation) shall be provided with nylon straps.
 - 2. Products shall meet ANSI A13.1.
 - 3. Ink shall be UV resistant.
 - 4. Manufacturers whose products may be used in this application, include, but are not necessarily limited to, the following:
 - a. Brady
 - b. Seton

2.04 VALVE TAGS:

- A. Provide a list of all valves utilized for this project which will include the following:
 - 1. Valve # as described below.
 - 2. Valve location.
 - 3. Architectural Room # to which service is provided by the valve.
 - 4. Function served (ex. Ice machine, toilet room, etc.)
- B. Provide the information in a spreadsheet format on CD, and provide printed copies in the project manual. Contractor shall also provide a valve chart and schematic and post in the maintenance office.
- C. Valve tags shall be 1-1/2" diameter, 19 gage polished brass, with stamp engraved identification in 1/2" high letters, fastened to the valve with a solid brass chain.
- D. All valve tags shall include an alpha prefix to identify the system, (example: first water valve for domestic cold water is CW1). In existing buildings where a numbering system has already been established, coordinate with the owner.
- E. Abbreviations for Plumbing System Valves:
 - 1. DCW Domestic Cold Water
 - 2. DHW Domestic Hot Water
 - 3. DHWR Domestic Hot Water Return
- F. Note: The abbreviations noted above shall be used for piping markers in addition to those specified herein.
- G. Manufacturers whose products may be used in this application, include, but are not necessarily limited to, the following:
 - 1. Brady
 - 2. Seton

2.05 EQUIPMENT NAMEPLATES

- A. Manufacturer's Nameplate: For each piece of equipment, provide a permanent operational data nameplate indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.
- B. Equipment Identification Nameplate: For each piece of equipment, provide a permanent identification nameplate labeled with the same number as shown on drawings or indicated in the specifications. Each piece of equipment shall have a unique identification number. Where existing facilities have an established numbering system, incorporate new identification numbers with existing numbering logic. Provide 1/16" rigid 2 ply blended acrylic extruded sheet with cap and core permanently fused together. Material shall be shatterproof and chip resistant and have matte finish. Nameplates shall meet ASTM D 709 Type I spec. For nameplates in exterior locations provide nameplate extruded from UV type sheet stock.

2.06 FIRESTOPPING AND SMOKESTOPPING

- A. Provide firestopping at pipe penetrations of fire-rated walls, floors and ceilings. Maintain integrity (rating) of such walls, floors and ceilings.

- B. Provide smokestopping at pipe penetrations of non-fire-rated walls, floors, and ceilings.
- C. Refer to fire safing requirements specified in Division 7.
- D. All through penetrations shall be labeled on both sides of the wall to indicate the appropriate UL system number, product used, installation date, hour rating installer, location number and telephone contact for the corresponding manufacturer. Material installed shall be as required for installation conditions and to achieve the required fire resistance.
- E. Use only firestop products that have been UL 1479, ASTM E-814, or UL2079 tested for specific fire rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire rating involved for each separate instance.
- F. Keep areas of work accessible until inspection by applicable code authorities.

2.07 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

2.08 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- C. Pressure Plates: Carbon steel. Include two for each sealing element.
- D. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.09 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: Polished chrome-plated with set screw.
- D. Split-Casting, Cast-Brass Type: Polished chrome-plated with concealed hinge and set screw.

2.10 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.

- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 degrees F.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 300-psig minimum working pressure as required to suit system pressures.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and non-corrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 degrees F.
- F. Dielectric Nipples: Electroplated steel nipple with inert and non-corrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 degrees F.

2.11 PIPING EXPANSION JOINTS AND FLEXIBLE CONNECTORS

- A. Products manufactured, tested, and approved by the manufacturers of the piping material provided shall be approved.
- B. Provide flexible connectors where all pipes cross building expansion joints. Refer to architectural drawings for locations of all expansion joints.
- C. Provide flexible connectors where piping is connected to equipment which may produce vibration that could be transmitted to the piping..
- D. Manufacturers:
 - 1. Flexonics
 - 2. Stenflex
 - 3. Flexicraft
 - 4. Econflex
 - 5. Unaflex
 - 6. Hyspan

2.12 GROUT

- A. Description: ASTM C 1107, Grade B, non-shrink and non-metallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, non-staining, non-corrosive, non-gaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.13 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Manufacturers:
 - 1. B-Line Systems, Inc.; a division of Cooper Industries.
 - 2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
 - 3. GS Metals Corp.
 - 4. Power-Strut Div.; Tyco International, Ltd.
 - 5. Thomas & Betts Corporation.
 - 6. Tolco Inc.
 - 7. Unistrut Corp.; Tyco International, Ltd.

- C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
- D. Non-metallic Coatings: Plastic coating, jacket, or liner.

2.14 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers:
 - a. Hilti, Inc.
 - b. ITW Ramset/Red Head.
 - c. Masterset Fastening Systems, Inc.
 - d. MKT Fastening, LLC.
 - e. Powers Fasteners.
- B. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers:
 - a. B-Line Systems, Inc.; a division of Cooper Industries.
 - b. Empire Industries, Inc.
 - c. Hilti, Inc.
 - d. ITW Ramset/Red Head.
 - e. MKT Fastening, LLC.
 - f. Powers Fasteners.

2.15 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.16 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and non-metallic grout; suitable for interior and exterior applications.
 - 1. Properties: Non-staining, non-corrosive, and non-gaseous.
 - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

2.17 TEMPORARY SERVICE

- A. Refer to Division 1 for contractor's requirements in regard to temporary services (temporary water for construction, construction sanitary facilities, temporary utilities, etc.

PART 3 EXECUTION

3.01 INSPECTION

- A. Installer must examine areas and conditions under which products are to be installed. Notify the architect and construction team, in writing, of conditions detrimental to proper completion of work. Starting of installation constitutes acceptance.

3.02 ARCHITECTURAL COORDINATION ITEMS

- A. Cut and drill all openings in walls and floors required for the installation. Secure approval of Engineer before cutting and drilling. Neatly patch all openings cut.
- B. Cutting and patching to be held to a minimum. Arrange for all sleeves and openings before construction is started.
- C. Patching through fire rated walls and enclosures shall not diminish the rating of that wall or enclosure. Patch shall be equal to rockwool, firestop, caulk or approved "rated" patch.
- D. Caulk or fire safe between sleeves and pipes, see Division 7 for caulking and fire safing requirements and the floor plan and partition schedule for partition ratings.
- E. Furnish all access panels required for proper servicing of equipment. Provide access panels for all concealed valves. Provide frame as required for finish. Exact locations to be approved by the Architect. Minimum size to be 12" x 12", units to be 16 gauge steel, locking device shall be screw-driver cam locks. Refer to Division 9 for access panel manufacturers and material requirements. Provide phenolic plate with ID of item behind access panel on the face of the door.
- F. Install standard Schedule 40 black steel pipe sleeves two sizes larger than pipes passing through floors, walls or masonry construction.
- G. Sleeves through walls to be cut flush with both faces.
- H. Sleeves through floor to extend one inch above finish floor top elevation.
- I. Caulk or fire safe between sleeves and pipes, see Division 7 for caulking and fire safing requirements and the floor plan partition schedule for partition ratings.
- J. Install manufactured chromium plated escutcheon plates wherever uninsulated exposed pipes pass through walls, floors, or ceilings. Escutcheon inside diameter to closely fit around pipe and outside diameter to completely cover opening.
- K. Furnish and set all forms required in masonry walls or foundation to accommodate pipes.

3.03 FRAMING FOR OPENINGS

- A. Where a pipe slot is indicated for a group of pipes passing through a wall, set a rectangular frame of structural angles, welded in the slot, at each side of wall. Close each side of opening with two (2) No. 16 USG galvanized steel plates cut to fit the pipes and/or pipe insulation closely, and fasten to angle frame. For slots in exterior walls, slip flanged ferrules of sheet metal on pipes when they are installed, with flanges inside the closure plates at exterior wall face, caulk ferrules and plates to make weathertight joint, and pack space between closure plates with rock wool or glass fiber. At slots in fire walls, pack as specified above, but omit ferrules and caulking. Escutcheons are by Division 22.
- B. Pipe Sleeves:

1. For pipes passing through brick or concrete walls, or concrete floor slabs, provide steel pipe sleeves, two (2) sizes larger than the pipe for which they are intended. Coordinate setting of sleeves as construction progresses. Set sleeves flush with finished line of walls and floors.
2. Caulk sleeves through foundation walls to make them watertight.

C. Fire-stopping /Smoke-stopping

1. Provide fire-stopping/smoke-stopping at pipe penetrations of walls, floors and ceilings. Maintain integrity (rating) of such walls, floors and ceilings.
2. Refer to Division 7 for installation requirements.

3.04 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 21 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping as follows:
1. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
 2. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
 3. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
 4. Install piping to permit valve servicing.
 5. Install piping free of sags and bends.
 6. Install piping to allow application of insulation.
- D. Install escutcheons for penetrations of walls, ceilings, and floors.
- E. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- F. Fire and Smoke-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop/smokestop materials.
- G. Verify final equipment locations for roughing-in.
- H. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.05 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of com-

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ponents. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

- D. Install equipment to allow right of way for piping installed at required slope.

3.06 INSTALLATION OF EQUIPMENT AND PIPING

- A. Follow manufacturer's suggested procedure for protection of equipment which will be idle for an extended period of time prior to start-up
- B. Mount and accurately align equipment prior too operation in strict accordance with manufacturer's recommendations and in accordance with procedures described below. In case of conflict, these procedures govern. Where structural or miscellaneous steel is not drilled, drill in field as directed.
- C. Lubricate all equipment as required and in accordance with manufacturer's recommendations. Furnish required lubricants.
- D. Suspended Equipment, Piping:
 - 1. Provide structural steel and steel rod hangers, rigid and workmanlike in appearance. Weld (with approval of Structural Engineer where attaching to building steel) structural steel hangers or bolt with hex head machine bolts and with spring lock washers under nuts.
 - 2. For suspension from concrete, provide steel or malleable iron inserts in poured concrete construction, as specified for pipe hangers and supports, and expansion shields, toggle bolts or lag screws, in other construction. Use electric drill with carbide bit for drilling concrete blocks.
 - 3. For suspension from structural steel, use beam or channel clamps with locking clips.
 - 4. Do not support mechanical components from ceiling grids.
 - 5. Do not suspend hangers from roof decks.
 - 6. Suspend from roof trusses and joists/joist girders only at panel points, at top cord only, unless otherwise indicated.
 - 7. Provide additional supports wherever needed, and structural steel members attached to building frame to provide additional points of support where required. Do no drilling on building structural and miscellaneous steel, except as directed or indicated.
 - 8. Do no attach hangers to suspension framing installed by other contractors.
- E. Equipment Set on Structural Steel: For bolting equipment directly to structural steel, provide machine bolts, lock washers and nuts
- F. Floor-Mounted Equipment: Set and level equipment on foundation. Grout in place, using non-ferrous grout, Sonogrout®, as manufactured by Sonneborn, Contech; Five Star®, as manufactured by U.S. Grout Corporation; Unisorb V-1®, as manufactured by Unisorb Machinery Installation, or equal. Provide wedges and shims for leveling.
- G. Refer to General Conditions for general close-out requirements. Maintain daily log of operational data on mechanical equipment and systems through the close-out period; record hours of operation, assigned personnel, fuel consumption and similar information; submit copy to Owner.
- H. Turn Over of Operation: Upon Substantial Completion, turn over prime responsibility for operation of mechanical equipment and systems to Owner's personnel. However, until time of final acceptance, respond promptly with consultation and services, as required. Provide one (1) operating engineer, who is completely familiar with the work, to consult with and continue training Owner personnel.

3.07 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

3.08 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.09 TRIMMING

- A. Inspect pipe supports, in occupied and equipment spaces for sharp angles which protrude into path of occupants and may cause injury. Trim such protrusions or cover with a suitable spongy material to prevent such injuries.

3.10 CUTTING AND PATCHING

- A. Comply with General Conditions for cutting and patching of other work, to accommodate the installation of mechanical work. Except as individually authorized by the Architect, cutting and patching of mechanical work to accommodate the installation of other work is not permitted, other than necessary penetrations of mechanical sheet metal work for electrical conduit and similar purposes.

3.11 EXCAVATING AND BACKFILLING

- A. Refer to the site utilities and excavation and backfilling sections for exterior underground piping installation.
- B. Comply with all codes in jurisdiction. Provide slope sides, shore and brace as required for stability.
- C. Perform all excavation and backfilling required for this work and shall consult with utilities prior to beginning excavation.
- D. Remove materials of every nature and description encountered in obtaining indicated lines and grades as shown on drawings. No extras will be allowed due to variations of proportion and the variation of materials.
- E. All piping shall be laid on a bed of sand, 6" deep, well tamped into place and properly graded to permit the pipe to have an even bearing throughout its entire length. Sand shall be installed around the piping and to a point 6" above the piping.
- F. Excess excavated earth materials shall be removed from the site.
- G. All backfilling above piping shall be flowable fill or bankrun gravel with clay compaction above to the subbase.

- H. All backfilling under pavement and sidewalks shall be flowable fill up to paving base/subbase material(s). All excavations shall be compacted to prevent settling.
 - 1. Roadways, walks and slabs 100%
 - 2. Yard areas 95%
- I. Compaction shall be performed in 12" lifts and spread evenly.
- J. Pay for all expenses for the proper restoration of all streets, sidewalks, concrete and blacktop surfaces broken for installing piping.

3.12 CONTROLLED LOW STRENGTH MATERIAL (FLOWABLE BACKFILL)

- A. Description: A Controlled-Low-Strength-Material (CLSM) is a material that has a specified compressive strength of 1200 pounds per square inch (PSI) or less at 28 days. This material is not concrete and is in a flowable state at the time of placement.

- B. Materials

- 1. A CLSM mixture consists of water, Portland cement, Type "F" fly ash and fine aggregate.
 - 2. If fly ash is not used, CLSM may be produced using high dosages of an air entraining admixture to help flowability and lower strength for removability.
 - 3. Non-standard materials may be used with the approval of the Engineer.
 - 4. Cement shall be Type I or II Portland cement conforming to ASTM C-150 and Type "F" fly ash.
 - 5. Water used in mixing or curing shall be as clean and free of oil, salt, acid, alkali, sugar, vegetable, or other substances injurious to the finished product as possible. Water will be tested in accordance with the requirements to AASHTO T 26. Water known to be of potable quality may be used without testing.
 - 6. Fine aggregates conforming to ASTM C 33 shall be used in CLSM.

- C. Mix Design

- 1. The proportion of materials used in CLSM shall be as follows:

<u>Material</u>	<u>Quantity</u>
Cement	50-100 pounds (lbs) per cubic yard (cy)
Type "F", Fly Ash	250-300 lbs/cy
Sand	2700-2800 lbs/cy
Water	400-500 lbs/cy

- 2. Other proportions may be used upon approval of the Engineer.
 - 3. The mixture used shall conform to the following flowability test:
 - a. A 3-inch diameter by 6-inch long open ended cylinder will be filled with the mixture, then struck off to level. The cylinder will be removed by pulling straight up and the diameter of the CLSM, after spreading, must be a minimum of 8-inches.

- D. Mixing and Transportation: CLSM must be transported by mixer truck. Agitation is required at all times from mixing to placement.

- E. Placement: CLSM shall be placed directly from the truck chute or it may be pumped. No additional compaction is required.

3.13 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 5 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.14 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Refer to Division 6 for wood blocking requirements as they may be requirements for fire-retardant wood and LEED compliant materials to be provided.
- B. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.
- C. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- D. Attach to substrates as required to support applied loads.

3.15 CONCRETE BASES

- A. Coordinate concrete work in this Article with Division 3 Section "Cast-in-Place Concrete".
- B. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit. Provide 1/2-inch 45 degree chamfer on all top edges.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 7. Use 4000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement steel and/or mesh.

3.16 GROUTING

- A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.

- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

3.17 MECHANICAL SYSTEM IDENTIFICATION

- A. Signs: Provide stencil-painted identification on rooftop equipment, with lettering size not less than 1-1/2". Provide engraved plastic-laminate signs at locations of major equipment units, primary control devices, emergency equipment, dangerous elements of mechanical work and similar places. Provide text of sufficient size to convey adequate information at each location, and mount permanently in an appropriate and effective location. Comply with recognized industry standards for color and design.
- B. Operational Tags: Provide proper and adequate information on operation and maintenance of mechanical systems, provide tags of plasticized card stock, with pre-painted or hand printed, to convey the message; example: "DO NOT CLOSE THIS VALVE EXCEPT WHEN BURNER IS OFF".

3.18 PAINTING, MARKING AND NAMEPLATE DATA

- A. Nameplate: For each piece of power operated mechanical equipment provide a permanent operational data nameplate indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.
- B. All exposed piping and equipment shall be identified by stenciling as follows (or as listed in the identification section).
 - 1. Provide directional arrows at least 4" long spaced at least every 50 feet.
 - 2. Contents of piping shall be labeled.
 - 3. Equipment shall be labeled with unit numbers same shown on drawings or indicated in specifications.
 - 4. Letters shall be 1" tall for piping.

3.19 CLEANING PREMISES

- A. During the progress of the work, clean up portions of the building in which work was performed in a clean and safe condition. Refer to Division 1.

3.20 SYSTEM TESTS

- A. Perform all system tests in the presence of an authorized representative of the Owner. Notify the Owner of all system's tests at least 48 hours in advance.
- B. Provide written documentation for each test completed that lists the item or system tested with all test criteria

3.21 SYSTEM INSPECTION

- A. All systems are to be inspected by authorized representative of the Owner before covering, enclosing or concealing of work. Notify Owner of all systems which are to be covered, enclosed or concealed at least 48 hours in advance.

3.22 MAINTENANCE, OPERATION INSTRUCTIONS, ETC.

- A. General: Before final acceptance of the project by the Owner, the Contractor shall schedule with the Owner's maintenance personnel, at a time mutually convenient, a training session. At this time, he will thoroughly familiarize the Owner's maintenance personnel with all operating and service procedures (routine and emergency) associated with the building systems and equipment. Provide the Owner with a list of all equipment including the following information:

1. Manufacturer's name.
2. Equipment model number
3. Equipment serial number.
4. Local sales representative (including postal & email addresses and telephone & fax numbers).
5. Parts list [complete with source(s) of supply].
6. Complete internal wiring diagrams.
7. Warranties.

- B. All directions for operation furnished by the manufacturer shall be carefully saved and turned over to the Owner, together with written sequence of operation, operating and maintenance schedules & instructions (routine and emergency) for each system and its equipment. All verbiage and units of measure shall be in English.

3.23 PROJECT SITE SAFETY

- A. The Engineer claims no expertise in and assumes no responsibility for any and all safety procedures and protocols associated with the Contractor's work. The Contractor shall exercise due diligence and comply with all established safety standards and regulations as listed by OSHA and any equipment manufacturers' requirements as they may relate to personal safety. The Contractor shall insure that all of his subcontractor(s) and/or tradesmen are apprised of all safety-related standards and procedures as they may relate to their work and immediately correct any violation of OSHA standards and regulations or equipment manufacturers' safety recommendations.

END OF SECTION

SECTION 22 05 17 –

SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.
4. Silicone sealants.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.03 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.04 QUALITY ASSURANCE

- A. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.01 SLEEVES

- A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop collar.
- B. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, anticorrosion coated or galvanized, with plain ends and integral welded waterstop collar.
- C. Galvanized-Steel Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- D. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

2.02 SLEEVE-SEAL SYSTEMS

A. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20 psig (137 kPa) minimum.
3. Sealing Elements: EPDM-rubber High-temperature-silicone interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
4. Pressure Plates: Carbon steel Composite plastic Stainless steel Stainless steel, Type 316.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B 633 of length required to secure pressure plates to sealing elements.

2.03 GROUT

- A. Description: Non-shrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi (34. 5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.04 SILICONE SEALANTS

- A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C 920, Type S, Grade NS, Class 25, Use NT.
- B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.

PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide annular clear space between piping and concrete slabs and walls.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas above finished floor level.

2. Using grout or silicone sealant, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
1. Cut sleeves to length for mounting flush with both surfaces.
 2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.
- E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.03 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
- B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.04 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than [NPS 6 (DN 150)]: Cast-iron pipe sleeves Steel pipe sleeves.
 - b. Piping [NPS 6 (DN 150)] and Larger: Cast-iron pipe sleeves Steel pipe sleeves.
 2. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than [NPS 6 (DN 150)]: Cast-iron pipe sleeves with sleeve-seal system Steel pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for [1-inch (25-mm)] annular clear space between piping and sleeve for installing sleeve-seal system.

- b. Piping [NPS 6 (DN 150)] and Larger: Cast-iron pipe sleeves with sleeve-seal system Steel pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for [1-inch (25-mm)] annular clear space between piping and sleeve for installing sleeve-seal system.
- 3. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than [NPS 6 (DN 150)]: Cast-iron pipe sleeves with sleeve-seal system Steel pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for [1-inch (25-mm)] annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping [NPS 6 (DN 150)] and Larger: Cast-iron pipe sleeves with sleeve-seal system Steel pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for [1-inch (25-mm)] <Insert dimension> annular clear space between piping and sleeve for installing sleeve-seal system.
- 4. Concrete Slabs above Grade:
 - a. Piping Smaller Than [NPS 6 (DN 150)]: Steel pipe sleeves PVC pipe sleeves.
 - b. Piping [NPS 6 (DN 150)] and Larger: Steel pipe sleeves PVC pipe sleeves.
- 5. Interior Partitions:
 - a. Piping Smaller Than [NPS 6 (DN 150)]: Steel pipe sleeves PVC pipe sleeves.
 - b. Piping [NPS 6 (DN 150)] and Larger: Galvanized-steel sheet sleeves.

END OF SECTION

SECTION 22 05 18 –
ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.03 QUALITY ASSURANCE

- A. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.01 ESCUTCHEONS

- A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.
- D. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed and exposed-rivet hinge; and spring-clip fasteners.

2.02 FLOOR PLATES

- A. Split Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
 - b. Chrome-Plated Piping: One-piece with polished, chrome-plated finish.
 - c. Insulated Piping: One-piece steel with finish.
 - d. Insulated Piping: One-piece stamped steel with polished, chrome-plated finish.
 - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with finish.
 - f. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stamped steel with polished, chrome-plated finish.
 - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece steel with finish.
 - h. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stamped steel with polished, chrome-plated finish.
 - 2. Escutcheons for Existing Piping to Remain:
 - a. Chrome-Plated Piping: Split-casting, stamped steel with hinge with polished, chrome-plated finish.
 - b. Insulated Piping: Split-plate, stamped steel with hinge with polished, chrome-plated finish.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped steel with hinge with polished, chrome-plated finish.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped steel with hinge with polished, chrome-plated finish.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. New Piping: Split floor plate.
 - 2. Existing Piping: Split floor plate.

3.02 FIELD QUALITY CONTROL

- A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION

SECTION 22 05 19 –

METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Liquid-in-glass thermometers.
 - 2. Dial-type pressure gages.
 - 3. Gage attachments.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.03 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of meter and gage.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

1.05 QUALITY ASSURANCE

- A. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.01 LIQUID-IN-GLASS THERMOMETERS

- A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:
 - 1. Standard: ASME B40.200.
 - 2. Case: Cast aluminum; 6-inch nominal size.
 - 3. Case Form: Straight unless otherwise indicated.
 - 4. Tube: Glass with magnifying lens and blue or red organic liquid.
 - 5. Tube Background: Non-reflective aluminum with permanently etched scale markings graduated in deg F.
 - 6. Window: Glass or plastic.

7. Stem: Aluminum or brass and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
 8. Connector: 3/4 inch, with ASME B1.1 screw threads.
 9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
- B. Plastic-Case, Compact-Style, Liquid-in-Glass Thermometers:
1. Standard: ASME B40.200.
 2. Case: Plastic; 6-inch nominal size.
 3. Case Form: Straight unless otherwise indicated.
 4. Tube: Glass with magnifying lens and blue[or red] organic liquid.
 5. Tube Background: Nonreflective with permanently etched scale markings graduated in deg F (deg C).
 6. Window: Glass or plastic.
 7. Stem: Aluminum or brass and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
 8. Connector: 3/4 inch , with ASME B1.1 screw threads.
 9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.02 PRESSURE GAGES

- A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
1. Standard: ASME B40.100.
 2. Case: Liquid-filled Open-front, pressure relief type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
 3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 4. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2 ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 5. Movement: Mechanical, with link to pressure element and connection to pointer.
 6. Dial: Non-reflective aluminum with permanently etched scale markings graduated in psi.
 7. Pointer: Dark-colored metal.
 8. Window: Glass or plastic.
 9. Ring: Metal, Brass, Stainless steel.
 10. Accuracy: Grade C, plus or minus 3 percent of middle half of scale range.
- B. Direct-Mounted, Plastic-Case, Dial-Type Pressure Gages:
1. Standard: ASME B40.100.
 2. Case: Sealed type; plastic; 4-1/2-inch nominal diameter.
 3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 4. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2 ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 5. Movement: Mechanical, with link to pressure element and connection to pointer.

6. Dial: Non-reflective aluminum with permanently etched scale markings graduated in psi.
7. Pointer: Dark-colored metal.
8. Window: Glass or plastic.
9. Accuracy: Grade C, plus or minus 3 percent of middle half of scale range.
10. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
11. Movement: Mechanical, with link to pressure element and connection to pointer.
12. Dial: Non-reflective aluminum with permanently etched scale markings graduated in psi.
13. Pointer: Dark-colored metal.
14. Window: Glass or plastic.
15. Ring: Metal Stainless steel.
16. Accuracy: Grade C, plus or minus 3 percent of middle half of scale range.

2.03 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston porous-metal-type surge-dampening device. Include extension for use on insulated piping.
- B. Valves: Brass ball, with NPS 1/2, ASME B1.20.1 pipe threads.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install thermos-wells with socket extending a minimum of 2 inches into fluid one-third of pipe diameter to center of pipe and in vertical position in piping tees.
- B. Install thermos-wells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermos-wells with extension on insulated piping.
- D. Fill thermos-wells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermos-wells and adjust vertical and tilted positions.
- F. Install remote-mounted thermometer bulbs in thermos-wells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
- G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- H. Install remote-mounted pressure gages on panel.
- I. Install valve and snubber in piping for each pressure gage for fluids.

- J. Install thermometers in the following locations:
 - 1. Inlet and outlet of each water heater supplying common area fixtures.
- K. Install pressure gages in the following locations:
 - 1. Building water service entrance into building.
 - 2. Suction and discharge of each domestic water pump.
- L. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.
- M. Adjust faces of meters and gages to proper angle for best visibility.

END OF SECTION

SECTION 22 05 23.12 –

BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 and NSF 372.

1.03 QUALITY ASSURANCE

- A. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
3. ASME B16.18 for solder-joint connections.
4. ASME B31.9 for building services piping valves.

- C. NSF Compliance: NSF 61 and NSF 372 for valve materials for potable-water service.

- D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

- F. Valve Sizes: Same as upstream piping unless otherwise indicated.

- G. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 4 and larger.
2. Hand-lever: For quarter-turn valves smaller than NPS 4.

H. Valves in Insulated Piping:

1. Include 2-inch stem extensions.
2. Extended operating handles of non-thermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

2.02 BRASS BALL VALVES

A. Brass Ball Valves, One-Piece:

1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 400 psig.
 - c. Body Design: One piece.
 - d. Body Material: Forged brass or bronze.
 - e. Ends: Threaded and soldered.
 - f. Seats: PTFE.
 - g. Stem: Brass or stainless steel.
 - h. Ball: Chrome-plated brass or stainless steel.
 - i. Port: Reduced.

B. Brass Ball Valves, Two-Piece with Full Port and Brass Trim, Threaded or Soldered Ends:

1. Description:
 - a. Standard: MSS SP-110 or MSS SP-145.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Forged brass.
 - e. Ends: Threaded and soldered.
 - f. Seats: PTFE.
 - g. Stem: Brass.
 - h. Ball: Chrome-plated brass.
 - i. Port: Full.

C. Brass Ball Valves, Two-Piece with Full Port and Brass Trim, Press Ends:

1. Description:
 - a. Standard: MSS SP-110 or MSS SP-145.
 - b. CWP Rating: Minimum 200 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Forged brass.
 - e. Ends: Press.
 - f. Press Ends Connection Rating: Minimum 200 psig.
 - g. Seats: PTFE or RPTFE.
 - h. Stem: Brass.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.
 - k. O-Ring: Buna-N or EPDM.

D. Brass Ball Valves, Two-Piece with Regular Port and Brass Trim:

1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Forged brass.
 - e. Ends: Threaded and soldered.
 - f. Seats: PTFE.
 - g. Stem: Brass.
 - h. Ball: Chrome-plated brass.
 - i. Port: Regular.

2.03 BRONZE BALL VALVES

1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 400 psig.
 - c. Body Design: One piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded.
 - f. Seats: PTFE.
 - g. Stem: Bronze.
 - h. Ball: Chrome-plated brass.
 - i. Port: Reduced.

B. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim, Threaded or Soldered Ends:

1. Description:
 - a. Standard: MSS SP-110 or MSS-145.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded and soldered.
 - f. Seats: PTFE.
 - g. Stem: Bronze or brass.
 - h. Ball: Chrome-plated brass.
 - i. Port: Full.

C. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim, Press Ends:

1. Description:
 - a. Standard: MSS SP-110 or MSS-145.
 - b. CWP Rating: Minimum 200 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Bronze.
 - e. Ends: Press.
 - f. Press Ends Connections Rating: Minimum 200 psig.
 - g. Seats: PTFE or RTPFE.
 - h. Stem: Bronze or brass.

- i. Ball: Chrome-plated brass.
 - j. Port: Full.
 - k. O-Ring Seal: EPDM or Buna-N.
- D. Bronze Ball Valves, Two-Piece with Regular Port and Bronze or Brass Trim:

- 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded.
 - f. Seats: PTFE.
 - g. Stem: Bronze or brass.
 - h. Ball: Chrome-plated brass.
 - i. Port: Regular.

PART 3 - EXECUTION

3.01 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

3.02 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
- B. Select valves with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - 2. For Steel Piping, NPS 2 and Smaller: Threaded ends.

3.03 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (**150 PSIG** OR LESS)

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Brass ball valves, one piece.
 - 3. Bronze ball valve, one piece with bronze trim.
 - 4. Brass ball valves, two-piece with regular port and brass trim.
 - 5. Bronze ball valves, two-piece with regular port and bronze or brass trim.

3.04 HIGH-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (**150 TO 200 PSIG**)

A. Pipe NPS 2 and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Brass ball valve, one piece.
3. Bronze ball valve with bronze trim, one piece.
4. Brass ball valves, two-piece with regular port and brass trim.
5. Bronze ball valves, two-piece with regular port and bronze or brass trim.

3.05 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Brass ball valve, one piece. Provide with threaded or solder-joint ends.
2. Bronze ball valve, one piece with bronze trim. Provide with threaded or solder-joint ends.
3. Brass ball valves, two-piece with regular port and brass trim. Provide with threaded solder or press connection-joint ends.
4. Bronze ball valves, two-piece with regular port and bronze or brass trim. Provide with threaded solder or press-connection-joint ends.

END OF SECTION

SECTION 22 05 23.14 –
CHECK VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Bronze swing check valves.
 - 2. Bronze swing check valves, press ends.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of valve.
 - 1. Certification that products comply with NSF 61 and NSF 372.

1.03 QUALITY ASSURANCE

- A. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B1.20.1 for threads for threaded end valves.
 - 2. ASME B16.1 for flanges on iron valves.
 - 3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 4. ASME B16.18 for solder joint.
 - 5. ASME B31.9 for building services piping valves.
- C. Drinking Water System Components - Health Effects and Drinking Water System Components - Lead Content Compliance: NSF 61 and NSF 372.
- D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valve Bypass and Drain Connections: MSS SP-45.

2.02 BRONZE SWING CHECK VALVES

- A. Bronze Swing Check Valves with Bronze Disc, Class 125:
 - 1. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded or soldered. See valve schedule articles.
 - f. Disc: Bronze.
- B. Bronze Swing Check Valves with Nonmetallic Disc, Class 125:
 - 1. Description:
 - a. Standard: MSS SP-80, Type 4.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded or soldered. See valve schedule articles.
 - f. Disc: PTFE.
- C. Bronze Swing Check Valves, Press Ends:
 - 1. Description:
 - a. Standard: MSS SP-80 and MSS SP-139.
 - b. CWP Rating: Minimum 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 584, bronze.
 - e. Ends: Press.
 - f. Press Ends Connection Rating: Minimum 200 psig.
 - g. Disc: Brass or bronze.

2.03 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install swing check valves for proper direction of flow in horizontal position with hinge pin level.

2.04 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

2.05 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
 - b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or spring; metal-seat or resilient-seat check valves.
 - c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
- C. End Connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded or soldered or press-ends.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged or threaded.
 - 3. For Copper Tubing, NPS 5 and Larger: Flanged.
 - 4. For Steel Piping, NPS 2 and Smaller: Threaded.
 - 5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged or threaded.
 - 6. For Steel Piping, NPS and Larger: Flanged.

2.06 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze swing check valves bronze nonmetallic disc, Class 125, with soldered or threaded end connections.
 - 2. Bronze swing check valves with press-end connections.
- B. Pipe NPS 2-1/2 and Larger:
 - 1. Iron swing check valves with metal seats, Class 125, with threaded or flanged end connections.
 - 2. Iron swing check valves with closure control, lever and spring, Class 125, with threaded or flanged end connections.

END OF SECTION

SECTION 22 05 29 –

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal hanger-shield inserts.
4. Fastener systems.
5. Pipe-positioning systems.
6. Equipment supports.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.03 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.04 QUALITY ASSURANCE

- A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.
- B. Pipe Welding Qualifications: Qualify procedures and operators according to "2015 ASME Boiler and Pressure Vessel Code, Section IX."

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

2.02 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

- 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
- 2. Galvanized Metallic Coatings: Pre-galvanized, hot-dip galvanized, or electro-galvanized.
- 3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
- 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
- 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Stainless-Steel Pipe Hangers and Supports:

- 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
- 2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
- 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe and Tube Hangers:

- 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
- 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.03 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.04 THERMAL HANGER-SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.05 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Hilti, Inc.
 - b. ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - c. MKT Fastening, LLC.
- B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. B-line, an Eaton business.
 - b. Empire Tool and Manufacturing Co., Inc.
 - c. Hilti, Inc.
 - 2. Indoor Applications: Zinc-coated or stainless steel.
 - 3. Outdoor Applications: Stainless steel.

2.06 PIPE-POSITIONING SYSTEMS

- A. Description: IAPMO PS 42 positioning system composed of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.07 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-carbon-steel shapes.

2.08 MATERIALS

- A. Aluminum: ASTM B 221.
- B. Carbon Steel: ASTM A 1011/A 1011M.

- C. Structural Steel: ASTM A 36/A 36M carbon-steel plates, shapes, and bars; black and galvanized.
- D. Stainless Steel: ASTM A 240/A 240M.
- E. Grout: ASTM C 1107/C 1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Non-staining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.01 APPLICATION

- A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.02 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Pipe-Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- M. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
 - 5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 - 6. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.03 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.04 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work.

3.05 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.06 PAINTING

- A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal are specified in
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A 780/A 780M.

3.07 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not

- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal hanger-shield inserts for insulated piping and tubing.
- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
 - 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 - 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
 - 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 8.
 - 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 3.
 - 12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 - 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 - 14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 - 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 - 16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
 - 17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if

longitudinal movement caused by expansion and contraction occurs.

18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction occurs.
 19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction occurs but vertical adjustment is unnecessary.
 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction occurs and vertical adjustment is unnecessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation, in addition to expansion and contraction, is required.
- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment of up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11 split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- P. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- R. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

SECTION 22 05 53 –
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.01 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. LEM Products Inc.
 - b. Marking Services, Inc.
 - c. Seton Identification Products.
 2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
 3. Letter Color: Blue.
 4. Background Color: White.
 5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 8. Fasteners: Stainless-steel rivets or self-tapping screws.
 9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 WARNING SIGNS AND LABELS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. LEM Products Inc.
 2. Seton Identification Products.
 3. Stranco, Inc.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- C. Letter Color: Red.
- D. Background Color: White.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- H. Fasteners: Stainless-steel rivets or self-tapping screws.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Label Content: Include caution and warning information plus emergency notification instructions.

2.03 PIPE LABELS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Carlton Industries, LP.
 2. LEM Products Inc.
 3. Seton Identification Products.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- C. Pre-tensioned Pipe Labels: Pre-coiled, semi-rigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

- D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: Size letters according to ASME A13.1 for piping.

PART 3 - EXECUTION

3.01 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.02 PIPE LABEL INSTALLATION

- A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- B. Pipe Label Color Schedule:
 - 1. Domestic Water Piping
 - a. Background:
 - b. Letter Colors:
 - 2. Sanitary Waste] and Storm Drainage Piping:
 - a. Background Color: Safety white.
 - b. Letter Color: Black.

END OF SECTION

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic hot water piping.
2. Domestic cold water piping.
3. Supplies and drains for handicap-accessible lavatories and sinks.

B. Related Sections:

1. Section 220716 "Plumbing Equipment Insulation."

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

1.03 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.04 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- B. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 1. Supply and Drain Protective Shielding Guards: ICC A117.1.
- C. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Buy America, Buy America (BABA).

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 1. Special-Shaped Insulation: ASTM C 552, Type III.
 2. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
 3. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
 4. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
- H. Mineral-Fiber, Preformed Pipe Insulation:
 1. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.02 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.03 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.
 - 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- E. Grade A for bonding insulation jacket lap seams and joints.
- F. PVC Jacket Adhesive: Compatible with PVC jacket.

2.04 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 - 1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
 - 3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 4. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
 - 1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
 - 3. Solids Content: 60 percent by volume and 66 percent by weight.
 - 4. Color: White.

2.05 SEALANTS

- A. Joint Sealants for Cellular-Glass Products:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Permanently flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
 - 4. Color: White or gray.
- B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
4. Color: White.

2.06 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.07 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
1. Adhesive: As recommended by jacket material manufacturer.
 2. Color: Color-code jackets based on system. Color as selected by Architect.
 3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- C. Underground Direct-Buried Jacket: 125-mil- (3.2-mm-) thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

2.08 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Width: 3 inches (75 mm).
 2. Thickness: 11.5 mils (0.29 mm).
 3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
1. Width: 2 inches (50 mm).
 2. Thickness: 6 mils (0.15 mm).
 3. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
 4. Elongation: 500 percent.

5. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

2.09 SECUREMENTS

- A. Aluminum Bands: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, [1/2 inch (13 mm)] [3/4 inch (19 mm)] wide with closed seal.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.
- C. Wire: 0.080-inch (2.0-mm) nickel-copper alloy.

2.10 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers, :
 - 1. Description: Manufactured plastic wraps for covering plumbing fixture [hot-water supply] [hot- and cold-water supplies] and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.
- B. Protective Shielding Piping Enclosures, <Insert drawing designation>:
 - 1. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.

2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.03 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Section 078413 "Penetration Fire-stopping" for fire-stopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Fire-stopping."

3.04 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.05 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.06 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- #### A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.07 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.08 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

3.09 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Drainage piping located in crawl spaces.
 2. Underground piping.
 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold and Hot Water: Insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch (25 mm) thick.
 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
 3. Cellular Glass: 1 inch (25 mm) thick.
- B. Exposed Sanitary Drains, Domestic Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be one of the following:
1. Flexible Elastomeric: 1/2 inch thick.
 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.
 3. Cellular Glass: 1 inch (25 mm) thick.

3.13 -APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
1. None.
 2. PVC: 20 mils (0.5 mm) thick.
- D. Piping, Exposed:

1. None.
2. PVC: 20 mils (0.5 mm) thick.

END OF SECTION

SECTION 22 11 16
DOMESTIC WATER PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. CPVC piping.
3. PEX tube and fittings.
4. Piping joining materials.
5. Transition fittings.
6. Dielectric fittings.

B. Related Requirements:

1. Section 221113 "Facility Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.02 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.03 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.04 QUALITY ASSURANCE

A. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372.

2.02 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) water tube, annealed temper.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- F. Copper Unions:
 - 1. MSS SP-123.
 - 2. Cast-copper-alloy, hexagonal-stock body.
 - 3. Ball-and-socket, metal-to-metal seating surfaces.
 - 4. Solder-joint or threaded ends.
- G. Copper, Brass, or Bronze Pressure-Seal-Joint Fittings:
 - 1. Fittings: Cast-brass, cast-bronze, or wrought-copper with EPDM O-ring seal in each end. Sizes NPS 2-1/2 (DN 65) and larger with stainless steel grip ring and EPDM O-ring seal.
 - 2. Minimum 200-psig (1379-kPa) working-pressure rating at 250 deg F (121 deg C).
- H. Copper Push-on-Joint Fittings:
 - 1. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.
 - 2. Stainless-steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.

2.03 CPVC PIPING

- A. CPVC Pipe: ASTM F 441/F 441M, Schedule 40.
 - 1. CPVC Socket Fittings: ASTM F 438 for Schedule 40.
 - 2. CPVC Threaded Fittings: ASTM F 437, Schedule 80.
- B. CPVC Piping System: ASTM D 2846/D 2846M, SDR 11, pipe and socket fittings.
- C. CPVC Tubing System: ASTM D 2846/D 2846M, SDR 11, tube and socket fittings.

2.04 PEX TUBE AND FITTINGS

- A. Tube Material: PEX plastic according to ASTM F 876 and ASTM F 877.
- B. Fittings: ASTM F 1807, metal insert and copper crimp rings.
- C. Fittings: ASSE 1061, push-fit fittings.
- D. Manifold: Multiple-outlet, plastic or corrosion-resistant-metal assembly complying with ASTM F 876; with plastic or corrosion-resistant-metal valve for each outlet.

2.05 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials:
 - 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
 - 2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.
- E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
- F. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.
- G. Primer according to ASTM F 656.
- H. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.06 TRANSITION FITTINGS

- A. General Requirements:
 - 1. Same size as pipes to be joined.
 - 2. Pressure rating at least equal to pipes to be joined.
 - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- C. Plastic-to-Metal Transition Fittings:
 - 1. Description:
 - a. CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
 - b. One end with threaded brass insert and one solvent-cement-socket or threaded end.
- D. Plastic-to-Metal Transition Unions:
 - 1. Description:
 - a. CPVC four-part union.
 - b. Brass or stainless-steel threaded end.
 - c. Solvent-cement-joint or threaded plastic end.
 - d. Rubber O-ring.
 - e. Union nut.

2.07 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
 - 1. Standard: ASSE 1079.
 - 2. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
 - 3. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 - 1. Standard: ASSE 1079.
 - 2. Factory-fabricated, bolted, companion-flange assembly.
 - 3. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
 - 4. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:
 - 1. Non-conducting materials for field assembly of companion flanges.
 - 2. Pressure Rating: 150 psig (1035 kPa).
 - 3. Gasket: Neoprene or phenolic.
 - 4. Bolt Sleeves: Phenolic or polyethylene.
 - 5. Washers: Phenolic with steel backing washers.
- E. Dielectric Nipples:
 - 1. Standard: IAPMO PS 66.
 - 2. Electroplated steel nipple complying with ASTM F 1545.
 - 3. Pressure Rating and Temperature: 300 psig (2070 kPa) at 225 deg F (107 deg C).
 - 4. End Connections: Male threaded or grooved.
 - 5. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.01 EARTHWORK

- A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.02 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

- C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."
- D. Install shutoff valve immediately upstream of each dielectric fitting.
- E. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."
- F. Install domestic water piping level without pitch and plumb.
- G. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- H. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- J. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- L. Install piping to permit valve servicing.
- M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- N. Install piping free of sags and bends.
- O. Install fittings for changes in direction and branch connections.
- P. Install PEX tubing with loop at each change of direction of more than 90 degrees.
- Q. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- R. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."
- S. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."
- T. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."
- U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

- V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.03 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- H. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
 - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 3. PVC Piping: Join according to ASTM D 2855.
- I. Joints for PEX Tubing: Join according to ASTM F 1807 for metal insert and copper crimp ring fittings and ASTM F 1960 for cold expansion fittings and reinforcing rings.
- J. Joints for PEX Tubing: Join according to ASSE 1061 for push-fit fittings.
- K. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.04 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 (DN 40) and Smaller: Fitting-type coupling.
 2. Fittings for NPS 2 (DN 50) and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 (DN 50) and Smaller: Plastic-to-metal transition [fittings] [or] [unions].

3.05 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric couplings or unions.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flange kits.
- D. Dielectric Fittings for NPS 5 (DN 125) and Larger: Use dielectric flange kits.

3.06 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 1. Vertical Piping: MSS Type 8 or 42, clamps.
 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.
 3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch (10 mm).
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
 2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
 3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
 4. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
 5. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
 6. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
- F. Install supports for vertical copper tubing every 10 feet (3 m).
- G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32) and Smaller: 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
 2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
 3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
 4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
 5. NPS 3 and NPS 3-1/2 (DN 80 and DN 90): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
 6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
 7. NPS 6 (DN 150): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.
- H. Install supports for vertical steel piping every 15 feet (4.5 m).
- I. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1 (DN 25) and Smaller: 36 inches (900 mm) with 3/8-inch (10-mm) rod.
 2. NPS 1-1/4 to NPS 2 (DN 32 to DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
 3. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
 4. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
 5. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
- J. Install supports for vertical CPVC piping every 60 inches (1500 mm) for NPS 1 (DN 25) and smaller, and every 72 inches (1800 mm) for NPS 1-1/4 (DN 32) and larger.
- K. Install vinyl-coated hangers for PEX tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1 (DN 25) and Smaller: 32 inches (815 mm) with 3/8-inch (10-mm) rod.
- L. Install hangers for vertical PEX tubing every 48 inches (1200 mm).
- M. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 2 (DN 50) and Smaller: 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
 2. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
 3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
 4. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
 5. NPS 8 (DN 200): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.
- N. Install supports for vertical PVC piping every 48 inches (1200 mm).
- O. Support piping and tubing not listed in this article according to MSS SP-58 and manufacturer's written instructions.

3.07 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

3.08 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

3.09 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
 - c. Re-inspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
 2. Piping Tests:
 - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - d. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

- e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
 - f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.10 ADJUSTING

- A. Perform the following adjustments before operation:
 - 1. Close drain valves, hydrants, and hose bibs.
 - 2. Open shutoff valves to fully open position.
 - 3. Open throttling valves to proper setting.
 - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
 - 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 - 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 - 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
 - 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-building-slab, domestic water, building-service piping, NPS 3 (DN 80) and smaller, shall be the following:
 - 1. Soft copper tube, ASTM B 88, Type K; joints.
- E. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 (DN 100 to DN 200) and larger, shall be the following:
 - 1. Soft copper tube, ASTM B 88, Type K (ASTM B 88M, Type A); wrought-copper, solder-joint fittings; and brazed joints.
- F. Under-building-slab, domestic water piping, NPS 2 (DN 50) and smaller, shall be the following:
 - 1. Soft copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); wrought-copper, solder-joint fittings; and brazed joints.
- G. Aboveground domestic water piping, NPS 2 (DN 50) and smaller, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); copper, solder-joint fittings; and soldered joints.
 - 2. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); copper pressure-seal-joint fittings; and pressure-sealed joints.
 - 3. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); copper push-on-joint fittings; and push-on joints.
 - 4. CPVC, Schedule 40; socket fittings; and solvent-cemented joints.
 - 5. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.
 - 6. CPVC Tubing System: CPVC tube; CPVC socket fittings; and solvent-cemented joints. NPS 1-1/2 (DN 40) and NPS 2 (DN 50) CPVC pipe with CPVC socket fittings may be used instead of tubing.
 - 7. PEX tube, NPS 1 (DN 25) and smaller.
 - a. Fittings for PEX tube:
 - 1) ASTM F 1807, metal insert and copper crimp rings.
 - 2) ASTM F 1960, cold expansion fittings and reinforcing rings.
 - 3) ASSE 1061, push-fit fittings.
- H. Aboveground domestic water piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100), shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); wrought-copper, solder-joint fittings; and soldered joints.

2. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); copper pressure-seal-joint fittings; and pressure-sealed joints.
3. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); grooved-joint, copper-tube appurtenances; and grooved joints.
4. CPVC, Schedule 40; socket fittings; and solvent-cemented joints.
5. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.

END OF SECTION

SECTION 22 11 19 –

DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Balancing valves.
4. Temperature-actuated, water mixing valves.
5. Strainers.
6. Wall hydrants.
7. Drain valves.
8. Water-hammer arresters.
9. Trap-seal primer valves.

B. Related Requirements:

1. Section 220519 "Meters and Gauges for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Section 221116 "Domestic Water Piping" for water meters.
3. Section 223200 "Domestic Water Filtration Equipment" for water filters in domestic water piping.
4. Section 224300 "Medical Plumbing Fixtures" for thermostatic mixing valves for sitz baths, thermostatic mixing-valve assemblies for hydrotherapy equipment, and outlet boxes for dialysis equipment.
5. Section 224500 "Emergency Plumbing Fixtures" for water tempering equipment.
6. Section 224713 "Drinking Fountains" for water filters for water coolers.
7. Section 224716 "Pressure Water Coolers" for water filters for water coolers.
8. Section 224723 "Remote Water Coolers" for water filters for water coolers.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For domestic water piping specialties.
 1. Include diagrams for power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.06 QUALITY ASSURANCE

- A. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping and components shall comply with NSF 61 and NSF 14.
- B. Comply with NSF 372 for low lead.

2.02 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 (860) psig (kPa) unless otherwise indicated.

2.03 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Standard: ASSE 1001.
2. Size: NPS 1/4 to NPS 3 (DN 8 to DN 80), as required to match connected piping.
3. Body: Bronze.
4. Inlet and Outlet Connections: Threaded.
5. Finish: Rough bronze.

- B. Hose-Connection Vacuum Breakers:

1. Standard: ASSE 1011.
2. Body: Bronze, non-removable, with manual drain.
3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
4. Finish: Chrome or nickel plated.

2.04 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers:

1. Standard: ASSE 1012.
2. Operation: Continuous-pressure applications.
3. Size: NPS 1/2 (DN 15); NPS 3/4 (DN 20).
4. Body: Bronze.
5. End Connections: Union, solder joint.
6. Finish: Rough bronze.

B. Reduced-Pressure-Principle Backflow Preventers:

1. Standard: ASSE 1013.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 10 psig (kPa) maximum, through middle third of flow range.
4. Size: 4 NPS (DN).
5. Design Flow Rate: 225 gpm (L/s).
6. Pressure Loss at Design Flow Rate: 10 psig (kPa) for sizes NPS 2 (DN 50) and smaller; 10 psig (kPa) for NPS 2-1/2 (DN 65) and larger.
7. Body: Bronze for NPS 2 (DN 50) and smaller; steel with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 (DN 65) and larger.
8. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
9. Configuration: Designed for horizontal, straight-through <Insert configuration> flow.
10. Accessories:
 - a. Valves NPS 2 (DN 50) and Smaller: Ball type with threaded ends on inlet and outlet.
 - b. Valves NPS 2-1/2 (DN 65) and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
 - c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.05 BALANCING VALVES

A. Memory-Stop Balancing Valves:

1. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
2. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
3. Size: NPS 2 (DN 50) or smaller.
4. Body: Copper alloy.
5. Port: Standard or full port.
6. Ball: Chrome-plated brass.
7. Seats and Seals: Replaceable.
8. End Connections: Solder joint or threaded.
9. Handle: Vinyl-covered steel with memory-setting device.

2.06 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

1. Standard: ASSE 1017.

2. Pressure Rating: 125 psig (860 kPa).
3. Type: Thermostatically controlled, water mixing valve.
4. Material: Bronze body with corrosion-resistant interior components.
5. Connections: Threaded inlets and outlet.
6. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
7. Tempered-Water Setting: 110 deg F (deg C).
8. Valve Finish: Chrome plated.

B. Primary, Thermostatic, Water Mixing Valves:

1. Standard: ASSE 1017.
2. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
3. Type: Exposed-mounted, thermostatically controlled, water mixing valve.
4. Material: Bronze body with corrosion-resistant interior components.
5. Connections: Threaded inlets and outlet.
6. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
7. Tempered-Water Setting: 120 deg F (deg C).
8. Pressure Drop at Design Flow Rate: 10 psig (kPa).
9. Valve Finish: Rough bronze.
10. Piping Finish: Copper.
11. Cabinet: Factory fabricated, stainless steel, for surface mounting and with hinged, stainless-steel door.

2.07 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 (DN 65) and larger.
3. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:
 - a. Strainers NPS 2 (DN 50) and Smaller: 0.020 (0.51) inch (mm).
 - b. Strainers NPS 2-1/2 to NPS 4 (DN 65 to DN 100): 0.045 (1.14) inch (mm).
6. Drain: Factory-installed, hose-end drain valve.

2.08 WALL HYDRANTS

A. Non-freeze Wall Hydrants:

1. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
2. Pressure Rating: 125 psig (860 kPa).
3. Operation: Loose key.
4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
5. Inlet: NPS 3/4 or NPS 1 (DN 20 or DN 25).
6. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounted with cover.

8. Box and Cover Finish: Polished nickel bronze.
9. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
10. Nozzle and Wall-Plate Finish: Polished nickel bronze.
11. Operating Keys(s): Two with each wall hydrant.

B. Vacuum Breaker Wall Hydrants:

1. Standard: ASSE 1019, Type A or Type B.
2. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
3. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
4. Pressure Rating: 125 psig (860 kPa).
5. Operation: Loose key.
6. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
7. Inlet: NPS 1/2 or NPS 3/4 (DN 15 or DN 20).
8. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.09 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
3. Size: NPS 3/4 (DN 20).
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.10 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:

1. Standard: ASSE 1018.
2. Pressure Rating: 125 psig (860 kPa) minimum.
3. Body: Bronze.
4. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
5. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
6. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Drainage-Type, Trap-Seal Primer Device:

1. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 (DN 10) minimum, trap makeup connection.
2. Size: NPS 1-1/4 (DN 32) minimum.
3. Material: Chrome-plated, cast brass.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Backflow Preventers: Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 - 1. Locate backflow preventers in same room as connected equipment or system.
 - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
 - 3. Do not install bypass piping around backflow preventers.
- B. Water Regulators: Install with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gauges on inlet and outlet.
- C. Balancing Valves: Install in locations where they can easily be adjusted.
- D. Temperature-Actuated, Water Mixing Valves: Install with check stops or shutoff valves on inlets and with shutoff valve on outlet.
 - 1. Install cabinet-type units recessed in or surface mounted on wall as specified.
- E. Y-Pattern Strainers: For water, install on supply side of each pump.
- F. Supply-Type, Trap-Seal Primer Device: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- G. Drainage-Type, Trap-Seal Primer Device: Install as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

3.02 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.
- C. Comply with requirements for grounding equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

3.03 IDENTIFICATION

- A. Plastic Labels for Equipment: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Pressure vacuum breakers.
 - 2. Intermediate atmospheric-vent backflow preventers.
 - 3. Reduced-pressure-principle backflow preventers.

4. Double-check, backflow-prevention assemblies.
 5. Carbonated-beverage-machine backflow preventers.
 6. Dual-check-valve backflow preventers.
 7. Reduced-pressure-detector, fire-protection, backflow-preventer assemblies.
 8. Double-check, detector-assembly backflow preventers.
 9. Water pressure-reducing valves.
 10. Automatic water shutoff valves.
 11. Calibrated balancing valves.
 12. Primary, thermostatic, water mixing valves.
 13. Manifold, thermostatic, water mixing-valve assemblies.
 14. Primary water tempering valves.
 15. Outlet boxes.
 16. Supply-type, trap-seal primer valves.
 17. Trap-seal primer systems.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.04 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
1. Test each pressure vacuum breaker reduced-pressure-principle backflow preventer double-check, backflow-prevention assembly according to authorities having jurisdiction and the device's reference standard.
- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.05 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION

SECTION 22 13 16 –
SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Hub-and-spigot, cast-iron soil pipe and fittings.
 - 2. PVC pipe and fittings.
 - 3. Specialty pipe fittings.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.03 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
- B. Field quality-control reports.

1.04 QUALITY ASSURANCE

- A. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

2.02 PIPING MATERIALS

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

- B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.03 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.04 PVC PIPE AND FITTINGS

- A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.
- B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- D. Adhesive Primer: ASTM F 656.
- E. Solvent Cement: ASTM D 2564.

2.05 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
 - 1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
 - 2. Unshielded, Non-pressure Transition Couplings:
 - a. Standard: ASTM C 1173.
 - b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - c. End Connections: Same size as and compatible with pipes to be joined.
 - d. Sleeve Materials:
 - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
 - 3. Shielded, Non-pressure Transition Couplings:
 - a. Standard: ASTM C 1460.
 - b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - c. End Connections: Same size as and compatible with pipes to be joined.

PART 3 - EXECUTION

3.01 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.02 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
 - 1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
 - 2. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- K. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
 - 1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
 - 2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.
 - a. Straight tees, elbows, and crosses may be used on vent lines.
 - 3. Do not change direction of flow more than 90 degrees.
 - 4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
 - a. Reducing size of waste piping in direction of flow is prohibited.

- L. Lay buried building waste piping beginning at low point of each system.
 - 1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
 - 2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
 - 3. Maintain swab in piping and pull past each joint as completed.
- M. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
 - 2. Horizontal Sanitary Waste Piping: 1 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- O. Install aboveground PVC piping according to ASTM D 2665.
- P. Install underground PVC piping according to ASTM D 2321.
- Q. Plumbing Specialties:
 - 1. Install backwater valves in sanitary waster gravity-flow piping.
 - a. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."
 - 2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
 - a. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
 - 3. Install drains in sanitary waste gravity-flow piping.
 - a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."
- R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- S. Install sleeves for piping penetrations of walls, ceilings, and floors.
 - 1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- T. Install sleeve seals for piping penetrations of concrete walls and slabs.
 - 1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.03 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- C. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.
- D. Plastic, Non-pressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
 3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

3.04 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
 1. Install transition couplings at joints of piping with small differences in ODs.
 2. In Waste Drainage Piping: Shielded, non-pressure transition couplings.

3.05 VALVE INSTALLATION

- A. Comply with requirements in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," Section 220523.14 "Check Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping" for general-duty valve installation requirements.
- B. Shutoff Valves:
 1. Install shutoff valve on each sewage pump discharge.
 2. Install gate or full-port ball valve for piping NPS 2 (DN 50) and smaller.
 3. Install gate valve for piping NPS 2-1/2 (DN 65) and larger.
- C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

3.06 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 3. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
 4. Vertical Piping: MSS Type 8 or Type 42, clamps.
 5. Install individual, straight, horizontal piping runs:
 - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.
 6. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 7. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting and coupling.
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
 2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
 3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
 4. NPS 6 and NPS 8 (DN 150 and DN 200): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
 5. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).
- G. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).
- H. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
 2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
 3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
 4. NPS 6 and NPS 8 (DN 150 and DN 200): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
- I. Install supports for vertical PVC piping every 48 inches (1200 mm).
- J. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written instructions.

3.07 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
 5. Install horizontal backwater valves in pit with pit cover flush with floor.
 6. Comply with requirements for cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
 7. Equipment: Connect waste piping as indicated.
 - a. Provide shutoff valve if indicated and union for each connection.
 - b. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections according to the following unless otherwise indicated:
1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
 2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.08 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping.
- B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.09 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

- a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.
 - a. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.
 - a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa).
 - b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
 - c. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.
 - a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa).
 - b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
 - c. Air pressure must remain constant without introducing additional air throughout period of inspection.
 - d. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.10 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.
- E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.11 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 (DN 100) and smaller shall be the following:
 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 3. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.

- C. Aboveground, soil and waste piping NPS 5 (DN 125) and larger shall be the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- D. Aboveground, vent piping NPS 4 (DN 100) and smaller shall be the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 3. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.
- E. Aboveground, vent piping NPS 5 (DN 125) and larger shall be the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.
- F. Underground, soil, waste, and vent piping NPS 4 (DN 100) and smaller shall be the following:
 - 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
 - 2. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 3. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.
- G. Underground, soil and waste piping NPS 5 (DN 125) and larger shall be the following:
 - 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
 - 2. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.
 - 3. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.

END OF SECTION

SECTION 22 13 19 –
SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Cleanouts.
2. Roof flashing assemblies.
3. Miscellaneous sanitary drainage piping specialties.

B. Related Requirements:

1. Section 221423 "Storm Drainage Piping Specialties" for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.
2. Section 224300 "Healthcare Plumbing Fixtures" for plaster sink interceptors.
3. Section 334200 "Stormwater Conveyance" for storm drainage piping and piping specialties outside the building.

1.02 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene.

B. PVC: Polyvinyl chloride.

1.03 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.04 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.05 QUALITY ASSURANCE

A. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.01 ASSEMBLY DESCRIPTIONS

- A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

2.02 CLEANOUTS

- A. Cast-Iron Exposed Cleanouts:
 - 1. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
 - 2. Size: Same as connected drainage piping
 - 3. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
 - 4. Closure: Countersunk, plug.
 - 5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
 - 6. Closure: Stainless-steel plug with seal.
- B. Cast-Iron Exposed Floor Cleanouts:
 - 1. Standard: ASME A112.36.2M for adjustable housing cast-iron soil pipe with cast-iron ferrule cleanout.
 - 2. Size: Same as connected branch.
 - 3. Type: Adjustable housing Cast-iron soil pipe with cast-iron ferrule.
 - 4. Body or Ferrule: Cast iron.
 - 5. Clamping Device: Not required.
 - 6. Outlet Connection: Inside calk.
 - 7. Closure: Brass plug with straight threads and gasket.
 - 8. Adjustable Housing Material: Cast iron with setscrews or other device.
 - 9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
 - 10. Frame and Cover Shape: Round.
 - 11. Top Loading Classification: Heavy Duty.
 - 12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
- C. Cast-Iron Wall Cleanouts:
 - 1. Standard: ASME A112.36.2M. Include wall access.
 - 2. Size: Same as connected drainage piping.
 - 3. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
 - 4. Closure Plug:
 - a. Cast iron.
 - b. Countersunk head.
 - c. Drilled and threaded for cover attachment screw.
 - d. Size: Same as or not more than one size smaller than cleanout size.
 - 5. Wall Access: Round, flat, chrome-plated brass or stainless steel cover plate with screw.
 - 6. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.03 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Description: Manufactured assembly made of 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch- (1.6-mm-) thick, lead flashing collar and skirt extending at least 6 inches (150 mm) from pipe, with galvanized-steel boot reinforcement and counter-flashing fitting.
 - a. Open-Top Vent Cap: Without cap.
 - b. Low-Silhouette Vent Cap: With vandal-proof vent cap.
 - c. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.04 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 (DN 15) side inlet.

B. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

C. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch (25 mm) above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

D. Stack Flashing Fittings:

1. Description: Counter-flashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

E. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

F. Expansion Joints:

1. Standard: ASME A112.6.4.
2. Body: Cast iron with bronze sleeve, packing, and gland.

3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.
 3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
 4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof. Comply with requirements in Section 076200, Sheet Metal Flashing and Trim.
- E. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof. Comply with requirements in Section 076200, Sheet Metal Flashing and Trim.
- F. Assemble open drain fittings and install with top of hub 2 inches (51 mm) above floor.
- G. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- H. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 2. Size: Same as floor drain inlet.
- I. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- J. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.
- K. Install vent caps on each vent pipe passing through roof.
- L. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
- M. Install wood-blocking reinforcement for wall-mounting-type specialties.

- N. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.02 CONNECTIONS

- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.03 FLASHING INSTALLATION

- A. Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
- B. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required.
- C. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.
- D. Set flashing on floors and roofs in solid coating of bituminous cement.
- E. Secure flashing into sleeve and specialty clamping ring or device.
- F. Install flashing for piping passing through roofs with counter-flashing or commercially made flashing fittings, according to Section 076200 "Sheet Metal Flashing and Trim."
- G. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.04 LABELING AND IDENTIFYING

- A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.
 - 1. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.05 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 22 13 19.13 –

SANITARY DRAINS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Floor drains.

1.02 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene styrene.
- B. FRP: Fiberglass-reinforced plastic.
- C. HDPE: High-density polyethylene.
- D. PE: Polyethylene.
- E. PP: Polypropylene.
- F. PVC: Polyvinyl chloride.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.04 QUALITY ASSURANCE

- A. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.01 DRAIN ASSEMBLIES

- A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary piping specialty components.

2.02 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg. Co.
2. Standard: ASME A112.6.3.
3. Pattern: Area Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.
10. Sediment Bucket: Not required.
11. Top or Strainer Material: Stainless steel.
12. Top of Body and Strainer Finish: Nickel bronze.
13. Top Shape: Round.
14. Top Loading Classification: Heavy Duty.
15. Inlet Fitting: Not required.
16. Trap Material: Cast iron.
17. Trap Pattern: Standard P-trap.
18. Trap Features: Cleanout and trap-seal primer valve drain connection.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 1. Position floor drains for easy access and maintenance.
 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
 3. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
 - b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
 - c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.
 4. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.
 - a. Maintain integrity of waterproof membranes where penetrated.
 5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- B. Install open drain fittings with top of hub 2 inches (51 mm) above floor.

3.02 CONNECTIONS

- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Comply with requirements in Section 221319 "Sanitary Waste Piping Specialties" for backwater valves, air admittance devices and miscellaneous sanitary drainage piping specialties.
- C. Comply with requirements in Section 221323 "Sanitary Waste Interceptors" for grease interceptors, grease-removal devices, oil interceptors, sand interceptors, and solid interceptors.
- D. Install piping adjacent to equipment to allow service and maintenance.
- E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.03 LABELING AND IDENTIFYING

- A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.04 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 22 34 00 - FUEL-FIRED DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following fuel-fired water heaters:
 - 1. Household, atmospheric, storage, gas water heaters.
 - 2. Household, direct-vent, storage, gas water heaters.
 - 3. Household, power-vent, storage, gas water heaters.
 - 4. Commercial, atmospheric, storage, gas water heaters.
 - 5. Commercial, high-efficiency, gas water heaters.
 - 6. Compression tanks.
 - 7. Water heater accessories.

1.3 DEFINITIONS

- A. LP Gas: Liquefied-petroleum fuel gas.

1.4 SUBMITTALS

- A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Product Certificates: For each type of commercial water heater, signed by product manufacturer.
- D. Manufacturer Seismic Qualification Certification: Submit certification that commercial water heaters, accessories, and components will withstand seismic forces defined in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment." Include the following:
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Source quality-control test reports.
- F. Field quality-control test reports.
- G. Operation and Maintenance Data: For water heaters to include in emergency, operation, and maintenance manuals.
- H. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain same type of water heaters through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of water heaters and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. ASME Compliance:
 1. Where ASME-code construction is indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.
 2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.
- E. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with potable water.
- F. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

1.6 COORDINATION

- A. Coordinate size and location of concrete bases with Architectural and Structural Drawings.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired water heaters that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 2. Warranty Period(s): From date of Substantial Completion:

- a. Commercial, Gas Water Heaters:
 - 1) Storage Tank: 5 years.
 - 2) Controls and Other Components: 5 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 COMMERCIAL, TANK TYPE GAS WATER HEATERS

- A. Commercial, Atmospheric, Storage, Gas Water Heaters: Comply with ANSI Z21.10.3/CSA 4.3.
 - 1. Manufacturers:
 - a. Smith, A. O. Water Products Company.
 - 2. Storage-Tank Construction: ASME-code steel with 150-psig working-pressure rating.
 - a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
 - 2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Lining Nickel plate complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
 - 3. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
 - e. Jacket: Steel with enameled finish.
 - f. Burner: For use with atmospheric water heaters and for natural-gas fuel.
 - g. Automatic Ignition: ANSI Z21.20, electric, automatic, gas-ignition system.

- h. Temperature Control: Adjustable thermostat.
 - i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
 - j. Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
- 4. Special Requirements: NSF 5 construction.
 - 5. Draft Hood: Draft diverter; complying with ANSI Z21.12.
 - 6. Automatic Damper: ANSI Z21.66, electrically operated, automatic-vent-damper device with size matching draft hood.
 - 7. Energy Management System Interface: Normally closed dry contacts for enabling and disabling water heater.
 - 8. Capacity and Characteristics:
 - a. Refer to plans.

2.3 COMPRESSION TANKS

- A. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
 - 1. Manufacturers:
 - a. Smith, A. O.; Aqua-Air Div.
 - 2. Construction:
 - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
 - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.
 - 3. Capacity and Characteristics:
 - a. Working-Pressure Rating: 150 psig.
 - b. Capacity Acceptable: 10 gal. minimum.
 - c. Air Pre-charge Pressure: 25psi

2.4 WATER HEATER ACCESSORIES

- A. Gas Shutoff Valves: ANSI Z21.15/CGA 9.1, manually operated. Furnish for installation in piping.
- B. Gas Pressure Regulators: ANSI Z21.18, appliance type. Include pressure rating, capacity, and pressure differential required between gas supply and water heater.
- C. Gas Automatic Valves: ANSI Z21.21, appliance, electrically operated, on-off automatic valve.

- D. Combination Temperature and Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select each relief valve with sensing element that extends into storage tank.
 - 1. Gas Water Heaters: ANSI Z21.22/CSA 4.4.
 - 2. Oil-Fired Water Heaters: ASME rated and stamped and complying with ASME PTC 25.3.
- E. Pressure Relief Valves: Include pressure setting less than working-pressure rating of water heater.
 - 1. Gas Water Heaters: ANSI Z21.22/CSA 4.4.
 - 2. Oil-Fired Water Heaters: ASME rated and stamped and complying with ASME PTC 25.3.
- F. Water Heater Stand and Drain Pan Units: High-density-polyethylene-plastic, 18-inch- high, enclosed-base stand complying with IAPMO PS 103 and IAS No. 2. Include integral or separate drain pan with raised edge and NPS 1 drain outlet with ASME B1.20.1 pipe thread.
- G. Water Heater Stands: Water heater manufacturer's factory-fabricated steel stand for floor mounting and capable of supporting water heater and water. Provide dimension that will support bottom of water heater a minimum of 18 inches above the floor.
- H. Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated steel bracket for wall mounting and capable of supporting water heater and water.
- I. Drain Pans: Corrosion-resistant metal with raised edge. Provide dimensions not less than base of water heater and include drain outlet not less than NPS 3/4.
- J. Piping Manifold Kits: Water heater manufacturer's factory-fabricated inlet and outlet piping arrangement for multiple-unit installation. Include piping and valves for field assembly that is capable of isolating each water heater and of providing balanced flow through each water heater.
- K. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

2.5 SOURCE QUALITY CONTROL

- A. Test and inspect water heater storage tanks, specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test commercial water heater storage tanks before shipment to minimum of one and one-half times pressure rating.
- C. Prepare test reports.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

- A. Install commercial water heaters on concrete bases.
 - 1. Exception: Omit concrete bases for commercial water heaters if installation on stand, bracket, suspended platform, or direct on floor is indicated.
 - 2. Concrete base construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

- B. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- C. Install seismic restraints for commercial water heaters. Anchor to substrate.
- D. Install gas water heaters according to NFPA 54.
- E. Install gas shutoff valves on gas supplies to gas water heaters without shutoff valves.
- F. Install gas pressure regulators on gas supplies to gas water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
- G. Install automatic gas valves on gas supplies to gas water heaters, if required for operation of safety control.
- H. Install oil-fired water heaters according to NFPA 31.
- I. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater, relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- J. Install combination temperature and pressure relief valves in water piping for water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- K. Install water heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 22 Section "Domestic Water Piping Specialties" for hose-end drain valves.
- L. Install thermometer on outlet piping of water heaters. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.
- M. Install pressure gage(s) on inlet and outlet piping of commercial, fuel-fired water heater piping. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.
- N. Assemble and install inlet and outlet piping manifold kits for multiple water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each water heater. Include shutoff valve and thermometer in each water heater inlet and outlet, and throttling valve in each water heater outlet. Refer to Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty valves and to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.
- O. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.
- P. Fill water heaters with water.
- Q. Charge compression tanks with air.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial water heaters. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 22 34 00

SECTION 22 40 00 –
PLUMBING FIXTURES

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Plumbing fixtures.
 - 2. Plumbing fittings and trim.
 - 3. Plumbing carriers.
- B. Provide installation and final connections.

1.02 DEFINITIONS

- A. Accessible Fixtures: Plumbing fixtures that can be accessed and used by people with disabilities.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and maintenance data.

1.04 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Regulatory Requirements: "Americans with Disabilities Act" for plumbing fixtures for people with disabilities.
- C. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- F. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.01 PLUMBING FIXTURES

- A. Refer to Drawings for Plumbing Fixture Schedule.

2.02 ACCESSIBLE FIXTURES

- A. Accessible fixtures to conform to all applicable code and regulatory requirements where indicated or as required.

2.03 PLUMBING FITTINGS, TRIM AND ACCESSORIES

- A. Water Outlets: At locations where water is supplied (by manual, automatic or remote control), provide commercial quality faucets, valves, or dispensing devices, of type and size indicated, and as required to operate as indicated. Include manual shutoff valves and connecting stem pipes to permit outlet servicing without shut-down of water supply piping systems.
- B. Vacuum Breakers: Provide with flush valves where required by governing regulations, including locations where water outlets are equipped for hose attachment.
- C. Check Valves: Provide in-line check valves on all domestic hot and cold water piping serving Mop Sinks and Kitchen Hose Spray/Reel assemblies.
- D. P-Traps: Include removable P-traps where drains are indicated for direct connection to drainage system.
- E. Carriers: Provide cast-iron supports for fixtures of either graphitic gray iron, ductile iron, or malleable iron as indicated.
- F. Fixture Bolt Caps: Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.
- G. Escutcheons: Where fixture supplies and drains penetrate walls in exposed locations, provide chrome plated cast-brass escutcheons with set screw.
- H. Aerators: Provide aerators of types approved by Health Departments having jurisdiction.
- I. Comply with additional fixture requirements contained in Plumbing Fixture Schedule attached to the Drawings.

2.04 PROTECTIVE COVERING FOR ACCESSIBLE FIXTURES

- A. Provide protective covering per ADA (Section 4.19.4), ADAAG (Section 606.5) and ICC/ANSI A117.1 (Section 606.6) for all domestic water supplies, traps and fixture drains under lavatories. PVC covers shall meet Testing Standard ASTM E 84-07 with a 25 flame spread/450 smoke index. With a one-piece design, fusion molded fabrication and pliable for high flexibility requirements. PVC covering material to be 1/8 inch thick. Surfaces to be soft, smooth, nonabsorbent, easy to clean U/V inhibited, antimicrobial, antifungal properties. Surfaces to be soft, smooth, non-absorbent, easy to clean U/V inhibited, antimicrobial, antifungal properties.
- B. For traps, the covering shall have a cleanout nut cap to allow service to the trap without disassembly. For stops, the covering shall have a lock lid that prevents tampering but allows access without removal of the insulation. Fasteners shall remain substantially out of sight.
- C. Option: The protective covering may be manufacturer-applied and integral with the supplies, trap and fixture drain.

2.05 MANUFACTURERS

- A. Available manufacturers: Subject to compliance with requirements, manufacturers offering plumbing fixtures and trim which may be incorporated in the work include:
1. Plumbing Fixtures:
 - a. Kohler
 2. Faucets/Flush Valves:
 - a. Kohler (Commercial)
 3. Fittings and Trim:
 - a. BrassCraft
 4. Fixture Seats:
 - a. Olsonite
 5. Stainless Steel Sinks:
 - a. Kohler
 6. Mop Sinks:
 - a. Stern-Williams
 7. Bathtubs and Showers:
 - a. Kohler
 8. Fixture Carriers:
 - a. Jay R Smith
 9. Protective Coverings:
 - a. Plumberex

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Responsibilities:
1. Receive, unload, securely store and protect product on site.
 2. Inspect products upon receipt for shortages, damages or defects and notify supplier within 48 hours.
 3. Notify supplier within 20 days of receipt of any hidden damages for products received.
- B. Review approved millwork shop drawing submittals from the General Trades Contractor. Coordinate location and size of countertop fixtures, casework and openings before proceeding with rough-in work. Verify that installation of countertop fixture will not interfere with operation of the casework.
- C. Install plumbing fixtures, fittings and trim per manufacturer's instructions and recommendations.
- D. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

- E. Install off-floor supports, securely affixed to building substrate, for wall-mounting fixtures.
 - 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 - 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
 - 3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- F. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- G. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- H. Install wall-mounting fixtures with tubular waste piping attached to supports.
- I. Install fixtures level and plumb according to roughing-in drawings.
- J. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
- K. Install controls for accessible fixtures on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- L. Install toilet seats on water closets.
- M. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- N. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- O. Install escutcheons at piping wall and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Results for Plumbing."
- P. Provide silicone-based caulking (color to match fixture) at all points where plumbing fixtures join adjacent surfaces. Refer to Division 7 Section "Joint Sealants" for additional requirements.

3.02 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, sanitary waste, and vent piping. Use size fittings required to match fixtures.

3.03 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Install fresh batteries in sensor-operated mechanisms.

3.04 PROTECTION

- A. Provide protective covering for installed fixtures, fittings and trim.
- B. Unless otherwise indicated on the Drawings or Specifications, the Contractor's use of the installed Plumbing Fixtures shall be as permitted in writing by the Owner. The Contractor shall maintain fixtures to the satisfaction of the Owner. The Owner shall have the right to terminate the Contractor's use of such fixtures at his discretion. Any of the installed fixtures (including fittings and trim) not authorized for use found damaged at the time of final inspection shall be removed and replaced by the Contractor at no additional cost to the Owner.

END OF SECTION

SECTION 23 81 13 - PACKAGED TERMINAL AIR-CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes packaged terminal air conditioners and their accessories and controls, in the following configurations:
 - 1. Through-the-wall air conditioners.
 - 2. Cooling units with electric heat.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, furnished specialties, electrical characteristics, and accessories.
- B. Shop Drawings: For packaged terminal air conditioners. Include plans, elevations, sections, details for wall penetrations, seismic bracing, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Color Samples: For unit cabinet, discharge grille, and exterior louver, and for each color and texture specified.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for packaged terminal air conditioners.
- E. Field quality-control reports.
- F. Operation and Maintenance Data: For packaged terminal air conditioners to include in emergency, operation, and maintenance manuals.
- G. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Ventilation Rate Procedures," and Section 7 - "Construction and Startup."

- C. Comply with material sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

1.5 COORDINATION

- A. Coordinate layout and installation of packaged terminal air conditioners and wall construction with other construction that penetrates walls or is supported by them.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged terminal air conditioners that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Sealed Refrigeration System: Manufacturer's standard, but not less than five years from date of Substantial Completion, including components and labor.
 - 2. Warranty Period for Nonsealed System Parts: Manufacturer's standard, but not less than five years from date of Substantial Completion, including only components and excluding labor.
 - 3. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings, First Company, or comparable product by one of the following:
 - 1. First Company Inc.

2.2 MANUFACTURED UNITS

- A. Description: Factory-assembled and -tested, self-contained, packaged terminal air conditioner with room cabinet, electric refrigeration system, heating, and temperature controls; fully charged with refrigerant and filled with oil; with hardwired chassis.

2.3 CHASSIS

- A. Cabinet: 0.052-inch thick steel with removable front panel with concealed latches.
 - 1. Mounting: Wall with wall sleeve.
 - 2. Discharge Grille: Extruded-aluminum discharge grille or Reversible polycarbonate discharge grille allowing upward and horizontal airflow.
 - 3. Louvers: Extruded aluminum with enamel finish; color per architectural drawings.
 - 4. Finish: Baked enamel.
 - 5. Access Door: Hinged door in top of cabinet for access to controls.
 - 6. Cabinet Extension: Matching cabinet in construction and finish, allowing diversion of airflow to adjoining room; with grille.
 - 7. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

8. Subbase: Enameled steel with adjustable leveling feet and adjustable end plates, with factory-installed and -wired, fused disconnect switch and receptacle sized for unit.
 9. Wall Sleeves: Galvanized steel with polyester finish.
- B. Refrigeration System: Direct-expansion indoor coil with capillary restrictor; and hermetically sealed scroll compressor with vibration isolation and overload protection.
1. Indoor and Outdoor Coils: Seamless copper tubes mechanically expanded into aluminum fins.
 2. Accumulator.
 3. Constant-pressure expansion valve.
 4. Reversing valve.
 5. Charge: R-32 or R-454B.
- C. Indoor Fan: Forward curved, centrifugal; with motor and positive-pressure ventilation damper with concealed manual operator.
- D. Filters: Washable polyurethane in molded plastic frame.
- E. Condensate Drain: Drain pan to direct condensate to building waste and vent piping.
1. Comply with ASHRAE 62.1 for drain pan construction and connections.
- F. Outdoor Fan: Forward curved, centrifugal or propeller type with separate motor.
1. Indoor and Outdoor Fan Motors: Two speed; comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - a. Fan Motors: Permanently lubricated split capacitor.
 - b. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - c. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

2.4 HEATING

- A. Electric-Resistance Heating Coil: Nickel-chromium-wire, electric-resistance heating elements with contactor and high-temperature-limit switch.

2.5 CONTROLS

- A. Control Module: Unit-mounted digital panel with touchpad temperature control and with touchpad for heating, cooling, and fan operation. Include the following features:
1. Low Ambient Lockout Control: Prevents cooling-cycle operation below 40 deg F outdoor air temperature.
 2. Building Automation System Interface: Allows remote on-off control with setback temperature control.
 3. Reverse-Cycle Defrost: Solid-state sensor monitors frost buildup on outdoor coil and reverses unit to melt frost.
- B. Remote Control: Standard unit-mounted controls with remote-mounted, low-voltage adjustable thermostat with heat anticipator, heat-off-cool-auto switch, and on-auto fan switch.

- C. Outdoor Air: Manual intake damper.

2.6 CAPACITIES AND CHARACTERISTICS

- A. Airflow: Refer to Drawings.
- B. Outdoor Air-Intake Rate: Refer to Drawings.
- C. Cooling Capacity:
 - 1. Total: Refer to Drawings.
 - 2. Sensible: Refer to Drawings.
 - 3. Energy-Efficiency Ratio: Refer to Drawings.
- D. Electric Heat Capacity: Refer to Drawings.
- E. Electrical Characteristics:
 - 1. Volts: 208
 - 2. Phase: Single.
 - 3. Hertz: 60.
 - 4. Full-Load Amperes: Refer to Drawings.
 - 5. Minimum Circuit Ampacity: Refer to Drawings.
 - 6. Maximum Overcurrent Protection: Refer to drawings.

2.7 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Factory test to comply with ARI 300, "Sound Rating and Sound Transmission Loss of Packaged Terminal Equipment."
- B. Unit Performance Ratings: Factory test to comply with ARI 310/380/CSA C744, "Packaged Terminal Air-Conditioners and Heat Pumps."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units level and plumb, maintaining manufacturer's recommended clearances and tolerances.
- B. Install wall sleeves in finished wall assembly; seal and weatherproof. Joint-sealant materials and applications are specified in Division 07 Section "Joint Sealants."
- C. Install and anchor wall sleeves to withstand, without damage to equipment and structure, seismic forces required by building code.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Division 23 Section "Hydronic Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Comply with requirements for piping specified in Division 23 Section "Facility Natural-Gas Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- C. Install piping adjacent to machine to allow service and maintenance.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
 - 1. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - 2. After installing packaged terminal air conditioners and after electrical circuitry has been energized, test for compliance with requirements.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Packaged terminal air conditioners will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.4 STARTUP SERVICE

- A. Perform startup service.
- B. After installation, verify the following:
 - 1. Unit is level on base and is flashed in exterior wall.
 - 2. Unit casing has no visible damage.
 - 3. Compressor, air-cooled condenser coil, and fans have no visible damage.
 - 4. Labels are clearly visible.
 - 5. Controls are connected and operable.
 - 6. Shipping bolts, blocks, and tie-down straps are removed.
 - 7. Filters are installed and clean.
 - 8. Drain pan and drain line are installed correctly.
 - 9. Electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 26 Sections.
 - 10. Installation. Perform startup checks according to manufacturer's written instructions, including the following:
 - a. Lubricate bearings on fan.
 - b. Check fan-wheel rotation for correct direction without vibration and binding.
- C. After startup service and performance test, change filters.

3.5 ADJUSTING

- A. Adjust initial temperature set points.
- B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain packaged terminal air conditioners.

END OF SECTION 23 81 13

SECTION 230500

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Equipment installation requirements common to equipment sections.
 - 3. Painting and finishing.
 - 4. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
 - 1. CPVC: Chlorinated polyvinyl chloride plastic.
 - 2. PE: Polyethylene plastic.
 - 3. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:
 - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 2. NBR: Acrylonitrile-butadiene rubber.

1.4 QUALITY ASSURANCE

- A. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
- B. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.6 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

2.2 JOINING MATERIALS

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
- B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- C. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- D. Solvent Cements for Joining Plastic Piping:
 - 1. CPVC Piping: ASTM F 493.
 - 2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
- E. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
- B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping free of sags and bends.
- E. Install fittings for changes in direction and branch connections.
- F. Install piping to allow application of insulation.
- G. Select system components with pressure rating equal to or greater than system operating pressure.
- H. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- I. Verify final equipment locations for roughing-in.
- J. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

- C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
 - D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
 - E. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 3. PVC Nonpressure Piping: Join according to ASTM D 2855.
- 3.3 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS
- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
 - B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
 - C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
 - D. Install equipment to allow right of way for piping installed at required slope.
- 3.4 PAINTING
- A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."
 - B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.
- 3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGES
- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
 - B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
- 3.6 ERECTION OF WOOD SUPPORTS AND ANCHORAGES
- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.
 - B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
 - C. Attach to substrates as required to support applied loads.

END OF SECTION 23 05 00

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Rotor: Random-wound, squirrel cage.
- F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- G. Temperature Rise: Match insulation rating.
- H. Insulation: Class F.
- I. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers:

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- 2.5 SINGLE-PHASE MOTORS
- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 1. Permanent-split capacitor.
 2. Split phase.
 3. Capacitor start, inductor run.
 4. Capacitor start, capacitor run.
 - B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
 - C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
 - D. Motors 1/20 HP and Smaller: Shaded-pole type.
 - E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 05 13

SECTION 230529

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Thermal-hanger shield inserts.
 - 4. Fastener systems.
 - 5. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.

3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
 - B. Stainless-Steel Pipe Hangers and Supports:
 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
 - C. Copper Pipe Hangers:
 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.
- 2.2 TRAPEZE PIPE HANGERS
- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.
- 2.3 THERMAL-HANGER SHIELD INSERTS
- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
 - B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.
 - C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
 - D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
 - E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.
- 2.4 FASTENER SYSTEMS
- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- 2.5 EQUIPMENT SUPPORTS
- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.
- 2.6 MISCELLANEOUS MATERIALS
- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
 - B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- L. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.

- c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
- d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
- e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
- 5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
- 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099113 "Exterior Painting" Section 099123 "Interior Painting" and Section 099600 "High Performance Coatings."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 - 6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 - 7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 - 8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
 - 9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 - 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 - 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 - 6. C-Clamps (MSS Type 23): For structural shapes.
 - 7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 - 8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 - 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
- P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 23 05 29

SECTION 230553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Duct labels.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Brimar Industries, Inc.
 - b. Craftmark Pipe Markers.
 - 2. Material and Thickness: Brass, 0.032-inch stainless steel, 0.025-inch aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 3. Letter Color: White.
 - 4. Background Color: Black.
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 - 7. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Brimar Industries, Inc.
 - b. Craftmark Pipe Markers.
 - 2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
 - 3. Letter Color: White.
 - 4. Background Color: Black.
 - 5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for

- greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
8. Fasteners: Stainless-steel rivets or self-tapping screws.
 9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.
- 2.2 WARNING SIGNS AND LABELS
- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 1. Brimar Industries, Inc.
 2. Craftmark Pipe Markers.
 - B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
 - C. Letter Color: Red.
 - D. Background Color: Black.
 - E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 - H. Fasteners: Stainless-steel rivets or self-tapping screws.
 - I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
 - J. Label Content: Include caution and warning information plus emergency notification instructions.
- 2.3 DUCT LABELS
- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 1. Brimar Industries, Inc.
 2. Craftmark Pipe Markers.
 - B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
 - C. Letter Color: White.
 - D. Background Color: Black.
 - E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 - H. Fasteners: Stainless-steel rivets or self-tapping screws.
 - I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
 - J. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.
 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 DUCT LABEL INSTALLATION

- A. Install plastic-laminated self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:
 - 1. Blue: For cold-air supply ducts.
 - 2. Yellow: For hot-air supply ducts.
 - 3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
- B. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION 23 05 53

SECTION 230713

DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulating the following duct services:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, concealed return located in unconditioned space.
 - 3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
- B. Related Sections:
 - 1. Section 230719 "HVAC Piping Insulation."
 - 2. Section 233113 "Metal Ducts" for duct liners.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
 - 3. Detail application of field-applied jackets.
 - 4. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- B. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 FIRE-RATED INSULATION SYSTEMS

- A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 1-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- C. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
- E. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- F. PVC Jacket Adhesive: Compatible with PVC jacket.
- G. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
 - 1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.

4. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
 1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 3. Solids Content: 60 percent by volume and 66 percent by weight.
 4. Color: White.

2.5 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 2. Fire- and water-resistant, flexible, elastomeric sealant.
 3. Service Temperature Range: Minus 40 to plus 250 deg F.
 4. Color: Aluminum.
 5. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:
 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 2. Fire- and water-resistant, flexible, elastomeric sealant.
 3. Service Temperature Range: Minus 40 to plus 250 deg F.
 4. Color: White.
 5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
 4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
 5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for ducts.

2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 1. Adhesive: As recommended by jacket material manufacturer.
 2. Color: White.

2.9 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 - 1. Width: 3 inches.
 - 2. Thickness: 11.5 mils.
 - 3. Adhesion: 90 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch in width.
 - 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 - 1. Width: 3 inches.
 - 2. Thickness: 6.5 mils.
 - 3. Adhesion: 90 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch in width.
 - 6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
 - 1. Width: 2 inches.
 - 2. Thickness: 6 mils.
 - 3. Adhesion: 64 ounces force/inch in width.
 - 4. Elongation: 500 percent.
 - 5. Tensile Strength: 18 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 - 1. Width: 2 inches.
 - 2. Thickness: 3.7 mils.
 - 3. Adhesion: 100 ounces force/inch in width.
 - 4. Elongation: 5 percent.
 - 5. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. ITW Insulation Systems; Illinois Tool Works, Inc.
 - 2. RPR Products, Inc.
- C. Insulation Pins and Hangers:
 - 1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
 - 2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.

- b. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
 - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
 - 3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive-backed base with a peel-off protective cover.
 - 4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
 - 5. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - 6. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
 - 7. Wire: 0.062-inch soft-annealed, stainless steel.
- 2.11 CORNER ANGLES
 - A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
 - B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

- 3.1 PREPARATION
 - A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- 3.2 GENERAL INSTALLATION REQUIREMENTS
 - A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
 - B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
 - C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
 - D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
 - E. Install multiple layers of insulation with longitudinal and end seams staggered.
 - F. Keep insulation materials dry during application and finishing.
 - G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
 - H. Install insulation with least number of joints practical.
 - I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
 1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
 1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

- E. Insulation Installation at Floor Penetrations:
 - 1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.4 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 - 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 - 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
 - 5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
 - 6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 - 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.5 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
 1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.6 FIRE-RATED INSULATION SYSTEM INSTALLATION

- A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
- B. Insulate duct access panels and doors to achieve same fire rating as duct.
- C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 078413 "Penetration Firestopping."

3.7 FINISHES

- A. Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
 - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, concealed return located in unconditioned space.
 - 3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
- B. Items Not Insulated:
 - 1. Fibrous-glass ducts.
 - 2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
 - 3. Factory-insulated flexible ducts.
 - 4. Factory-insulated plenums and casings.
 - 5. Flexible connectors.
 - 6. Vibration-control devices.
 - 7. Factory-insulated access panels and doors.

3.10 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 1.5-lb/cu. ft. nominal density.
- B. Concealed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
- C. Concealed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
- D. Concealed, Exhaust-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.

3.11 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Ducts and Plenums, Concealed:
 - 1. None.
 - 2. PVC: 20 mils thick.
 - 3. Aluminum, Smooth: 0.020 inch thick.

END OF SECTION 23 07 13

SECTION 230719

HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulating the following HVAC piping systems:
 - 1. Refrigerant suction and hot-gas piping, indoors and outdoors.
- B. Related Sections:
 - 1. Section 230713 "Duct Insulation."

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Detail removable insulation at piping specialties.
 - 6. Detail application of field-applied jackets.
 - 7. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- B. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

- E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
- C. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 - 1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 4. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
 - 1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 3. Solids Content: 60 percent by volume and 66 percent by weight.
 - 4. Color: White.

2.4 SEALANTS

- A. Joint Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Permanently flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 100 to plus 300 deg F.
 - 4. Color: White or gray.
 - 5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. FSK and Metal Jacket Flashing Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Fire- and water-resistant, flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 4. Color: Aluminum.
 - 5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 1. Width: 3 inches.
 2. Thickness: 11.5 mils.
 3. Adhesion: 90 ounces force/inch in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: 40 lbf/inch in width.
 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 1. Width: 3 inches.
 2. Thickness: 6.5 mils.
 3. Adhesion: 90 ounces force/inch in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: 40 lbf/inch in width.
 6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
 1. Width: 2 inches.
 2. Thickness: 6 mils.
 3. Adhesion: 64 ounces force/inch in width.
 4. Elongation: 500 percent.
 5. Tensile Strength: 18 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 1. Width: 2 inches.
 2. Thickness: 3.7 mils.
 3. Adhesion: 100 ounces force/inch in width.
 4. Elongation: 5 percent.
 5. Tensile Strength: 34 lbf/inch in width.

2.6 SECUREMENTS

- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
- B. staples, nominal 3/4-inch- wide, stainless steel or Monel.
- C. Wire: 0.062-inch soft-annealed, stainless steel.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Manholes.

5. Handholes.
6. Cleanouts.

3.3 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
 1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.4 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- C. Install removable insulation covers at locations indicated. Installation shall conform to the following:
 1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 1. Install pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.
 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Underground piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.9 INDOOR PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and Hot-Gas Piping: Flexible elastomeric, 1 inch thick.
- B. Refrigerant Suction and Hot-Gas Flexible Tubing: Flexible elastomeric, 1 inch thick.

3.10 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and Hot-Gas Piping: Insulation shall be the following:
 - 1. Flexible Elastomeric: 2 inches thick.
- B. Refrigerant Suction and Hot-Gas Flexible Tubing: Insulation shall be the following:
 - 1. Flexible Elastomeric: 2 inches thick.

END OF SECTION 23 07 19

SECTION 232300

REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Refrigerant pipes and fittings.
 - 2. Refrigerant piping valves and specialties.
 - 3. Refrigerants.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of valve and refrigerant piping specialty.
- B. Shop Drawings:
 - 1. Show piping size and piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
 - 2. Show interface and spatial relationships between piping and equipment.
 - 3. Shop Drawing Scale: 1/4 inch equals 1 foot.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."
- C. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-454B or R-32:
 - 1. Suction Lines for Air-Conditioning Applications: 300 psig.
 - 2. Suction Lines for Heat-Pump Applications: 535 psig.
 - 3. Hot-Gas and Liquid Lines: 535 psig.

2.2 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 280, Type ACR.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- E. Brazing Filler Metals: AWS A5.8/A5.8M.

2.3 VALVES AND SPECIALTIES

- A. Solenoid Valves: Comply with AHRI 760 and UL 429; listed and labeled by a National Recognized Testing Laboratory (NRTL).
 - 1. Body and Bonnet: Plated steel.
 - 2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
 - 3. Seat: Polytetrafluoroethylene.
 - 4. End Connections: Threaded.
 - 5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24-V ac coil.
 - 6. Working Pressure Rating: 400 psig.
 - 7. Maximum Operating Temperature: 240 deg F.
- B. Thermostatic Expansion Valves: Comply with AHRI 750.
 - 1. Body, Bonnet, and Seal Cap: Forged brass or steel.
 - 2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
 - 3. Packing and Gaskets: Non-asbestos.
 - 4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
 - 5. Suction Temperature: 40 deg F.
 - 6. Superheat: Adjustable.
 - 7. Reverse-flow option (for heat-pump applications).
 - 8. End Connections: Socket, flare, or threaded union.
 - 9. Working Pressure Rating: 700 psig.
- C. Moisture/Liquid Indicators:
 - 1. Body: Forged brass.
 - 2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
 - 3. Indicator: Color coded to show moisture content in parts per million (ppm).
 - 4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
 - 5. End Connections: Socket or flare.
 - 6. Working Pressure Rating: 500 psig.
 - 7. Maximum Operating Temperature: 240 deg F.

2.4 REFRIGERANTS

- A. ASHRAE 34, R-454B: R-32/1234yf (68.9/31/1)
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Arkema Inc.
 - b. DuPont Fluorochemicals Div.
 - c. Genetron Refrigerants; Honeywell International Inc.
 - d. Mexichem Fluor Inc.
- B. ASHRAE 34, R-32: Difluoromethane (Methylene fluoride).
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Arkema Inc.
 - b. DuPont Fluorochemicals Div.
 - c. Genetron Refrigerants; Honeywell International Inc.
 - d. Mexichem Fluor Inc.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-454B and R-32

- A. Suction Lines: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.
- B. Hot-Gas and Liquid Lines: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

- A. Install solenoid valves upstream from each expansion valve. Install solenoid valves in horizontal lines with coil at top.
- B. Install thermostatic expansion valves as close as possible to distributors on evaporators.
 - 1. Install valve so diaphragm case is warmer than bulb.
 - 2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
 - 3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.
- C. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- L. Install refrigerant piping in protective conduit where installed belowground.
- M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- N. Slope refrigerant piping as follows:
 - 1. Install horizontal suction lines with a uniform slope downward to compressor.
 - 2. Liquid lines may be installed level.
- O. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- P. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- Q. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."

- R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

3.4 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
 - 1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
 - 2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

3.5 HANGERS AND SUPPORTS

- A. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
 - 2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
 - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
 - 4. Spring hangers to support vertical runs.
 - 5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod diameters:
 - 1. NPS 1/2: Maximum span, 60 inches; minimum rod, 1/4 inch.
 - 2. NPS 5/8: Maximum span, 60 inches; minimum rod, 1/4 inch.
 - 3. NPS 1: Maximum span, 72 inches; minimum rod, 1/4 inch.
 - 4. NPS 1-1/4: Maximum span, 96 inches; minimum rod, 3/8 inch.
 - 5. NPS 1-1/2: Maximum span, 96 inches; minimum rod, 3/8 inch.
 - 6. NPS 2: Maximum span, 96 inches; minimum rod, 3/8 inch.
 - 7. NPS 2-1/2: Maximum span, 108 inches; minimum rod, 3/8 inch.
 - 8. NPS 3: Maximum span, 10 feet; minimum rod, 3/8 inch.
 - 9. NPS 4: Maximum span, 12 feet; minimum rod, 1/2 inch.
- D. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Comply with ASME B31.5, Chapter VI.
 - 2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
 - 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.
 - a. Fill system with nitrogen to the required test pressure.
 - b. System shall maintain test pressure at the manifold gage throughout duration of test.
 - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
 - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

- B. Prepare test and inspection reports.

3.7 SYSTEM CHARGING

- A. Charge system using the following procedures:
 - 1. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
 - 2. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.

3.8 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of air-conditioning to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
 - 1. Verify that compressor oil level is correct.
 - 2. Open compressor suction and discharge valves.
 - 3. Open refrigerant valves except bypass valves that are used for other purposes.
 - 4. Check open compressor-motor alignment and verify lubrication for motors and bearings.

END OF SECTION 23 23 00

SECTION 233113

METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings.
2. Round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233116 "Nonmetal Ducts" for fibrous-glass ducts, thermoset fiber-reinforced plastic ducts, thermoplastic ducts, PVC ducts, and concrete ducts.
3. Section 233119 "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.
4. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"

1. Seismic Hazard Level A: Seismic force to weight ratio, 0.48.
2. Seismic Hazard Level B: Seismic force to weight ratio, 0.30.
3. Seismic Hazard Level C: Seismic force to weight ratio, 0.15.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.

12. Hangers and supports, including methods for duct and building attachment and vibration isolation.
 - C. Delegated-Design Submittal:
 1. Sheet metal thicknesses.
 2. Joint and seam construction and sealing.
 3. Reinforcement details and spacing.
 4. Materials, fabrication, assembly, and spacing of hangers and supports.
 5. Design Calculations: Calculations for selecting hangers and supports.
- 1.4 INFORMATIONAL SUBMITTALS
- A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
 2. Suspended ceiling components.
 3. Structural members to which duct will be attached.
 4. Size and location of initial access modules for acoustical tile.
 5. Penetrations of smoke barriers and fire-rated construction.
 6. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Perimeter moldings.
 - B. Welding certificates.
- 1.5 QUALITY ASSURANCE
- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
 - B. Welding Qualifications: Qualify procedures and personnel according to the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
 3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
 - C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
 - D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
 - E. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

- 2.1 RECTANGULAR DUCTS AND FITTINGS
- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
 - B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
- B. Retain subparagraph below to require factory-fabricated, round ducts and fittings; delete to allow shop-fabricated ducts and fittings.
- C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Fabricate round ducts larger Than 90 inches in diameter with butt-welded longitudinal seams.
- E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G60.
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
- D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- E. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- F. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

- G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
 - 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 - 2. Tape Width: 3 inches.
 - 3. Sealant: Modified styrene acrylic.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 - 7. Service: Indoor and outdoor.
 - 8. Service Temperature: Minus 40 to plus 200 deg F.
 - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
 - 10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Water-Based Joint and Seam Sealant:
 - 1. Application Method: Brush on.
 - 2. Solids Content: Minimum 65 percent.
 - 3. Shore A Hardness: Minimum 20.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. VOC: Maximum 75 g/L (less water).
 - 7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 - 8. Service: Indoor or outdoor.
 - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Flanged Joint Sealant: Comply with ASTM C 920.
 - 1. General: Single-component, acid-curing, silicone, elastomeric.
 - 2. Type: S.
 - 3. Grade: NS.
 - 4. Class: 25.
 - 5. Use: O.
 - 6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- F. Round Duct Joint O-Ring Seals:
 - 1. Seal shall provide maximum 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
 - 2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
 - 3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 2. Outdoor, Supply-Air Ducts: Seal Class A.
 - 3. Outdoor, Exhaust Ducts: Seal Class C.
 - 4. Outdoor, Return-Air Ducts: Seal Class C.
 - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
 - 6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
 - 7. Unconditioned Space, Exhaust Ducts: Seal Class C.
 - 8. Unconditioned Space, Return-Air Ducts: Seal Class B.
 - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
 - 10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
 - 11. Conditioned Space, Exhaust Ducts: Seal Class B.
 - 12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 START UP

- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.7 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

- a. Pressure Class: Positive 1-inch wg.
- b. Minimum SMACNA Seal Class: A.
- c. SMACNA Leakage Class for Rectangular: 12.
- d. SMACNA Leakage Class for Round and Flat Oval: 12.

C. Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

- a. Pressure Class: Positive or negative 1-inch wg.
- b. Minimum SMACNA Seal Class: A.
- c. SMACNA Leakage Class for Rectangular: 12.
- d. SMACNA Leakage Class for Round and Flat Oval: 12.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

- a. Pressure Class: Negative 1-inch wg.
- b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
- c. SMACNA Leakage Class for Rectangular: 12.
- d. SMACNA Leakage Class for Round and Flat Oval: 12.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

- a. Pressure Class: Positive or negative 1-inch wg.
- b. Minimum SMACNA Seal Class: A.
- c. SMACNA Leakage Class for Rectangular: 12.
- d. SMACNA Leakage Class for Round and Flat Oval: 12.

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

G. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

- 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
- 2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:

- 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
- 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
- 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:

- 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
- 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
- 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

- a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
- b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.

- c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - 3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
 - 4) Radius-to Diameter Ratio: 1.5.
 - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.
- H. Branch Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Spin in.
 - 2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity 1000 fpm or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm: Conical tap.
 - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 23 31 13

SECTION 233116

NONMETAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fibrous-glass ducts and fittings.
 - 2. Phenolic-foam ducts and fittings.
- B. Related Sections:
 - 1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for nonmetal ducts.
 - 2. Section 233113 "Metal Ducts" for single- and double-wall, rectangular and round ducts.
 - 3. Section 233300 "Air Duct Accessories" for dampers, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 PERFORMANCE REQUIREMENTS

- A. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
 - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - 2. Duct layout indicating sizes and pressure classes.
 - 3. Elevation of top of ducts.
 - 4. Dimensions of main duct runs from building grid lines.
 - 5. Fittings.
 - 6. Reinforcement and spacing.
 - 7. Seam and joint construction.
 - 8. Penetrations through fire-rated and other partitions.
 - 9. Equipment installation based on equipment being used on Project.
 - 10. Hangers and supports, including methods for duct and building attachment and vibration isolation.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
 - 2. Suspended ceiling components.
 - 3. Structural members to which duct will be attached.
 - 4. Size and location of initial access modules for acoustical tile.
 - 5. Penetrations of smoke barriers and fire-rated construction.
 - 6. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Perimeter moldings.

1.5 QUALITY ASSURANCE

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
- C. NFPA Compliance:
 - 1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
 - 2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- D. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.1 FIBROUS-GLASS DUCTS AND FITTINGS

- A. Maximum performance parameters are static-pressure classes from minus 2- to plus 2-inch wg (minus 500 to plus 500 Pa), velocity up to 2400 fpm (12.2 m/s), and leakage class 6 cfm/100 sq. ft. at 1-inch wg (0.29 L/s per sq. m at 250 Pa) with all joints sealed. Fibrous-glass ducts are not appropriate for outdoor installation.
- B. Fibrous-Glass Duct Materials: Resin-bonded fiberglass, faced on the outside surface with fire-resistive FSK vapor retarder and with a smooth fiberglass mat finish on the air-side surface.
 - 1. Duct Board: Factory molded into rectangular boards.
 - 2. Round Duct: Factory molded into straight round duct and smooth fittings.
 - 3. Temperature Limits: 40 to 250 deg F inside ducts; 150 deg F ambient temperature surrounding ducts.
 - 4. Maximum Thermal Conductivity: 0.24 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - 5. Moisture Absorption: Not exceeding 5 percent by weight at 120 deg F and 95 percent relative humidity for 96 hours when tested according to ASTM C 1104/C 1104M.
 - 6. Permeability: 0.02 perms maximum when tested according to ASTM E 96/E 96M, Procedure A.
 - 7. Antimicrobial Agent: Compound shall be tested for efficacy by an NRTL, and registered by the EPA for use in HVAC systems.
 - 8. Noise-Reduction Coefficient: 0.65 minimum when tested according to ASTM C 423, Mounting A.
 - 9. Required Markings: EI rating, UL label, and other markings required by UL 181 on each full sheet of duct board.
- C. Closure Materials:
 - 1. Pressure-Sensitive Tape: Comply with UL 181A; imprinted by the manufacturer with the coding "181A-P," the manufacturer's name, and a date code.
 - a. Tape: Aluminum foil-scrim tape imprinted with listing information.
 - b. Minimum Tape Width: 2-1/2 inches; 3 inches for duct board thicker than 1 inch.
 - c. Staples: 1/2-inch outward clinching, 2 inches o.c. in tabs, one tab per joint.
 - d. Water resistant.
 - e. Mold and mildew resistant.
 - 2. Heat-Activated Tape: Comply with UL 181A; imprinted by the manufacturer with the coding "181A-H," the manufacturer's name, and a date code.
 - a. Tape: Aluminum foil-scrim tape imprinted with listing information.
 - b. Minimum Tape Width: 3 inches.
 - c. Heat-Sensitive Imprint: Printed indicator on tape to show proper heating during application has been achieved.
 - d. Water resistant.
 - e. Mold and mildew resistant.
 - 3. Two-Part Tape Sealing System: Comply with UL 181A; imprinted by the manufacturer with the coding "181A-M," the manufacturer's name, and a date code.

- a. Tape: Woven glass fiber impregnated with mineral gypsum.
 - b. Minimum Tape Width: 3 inches.
 - c. Sealant: Modified styrene acrylic.
 - d. Water resistant.
 - e. Mold and mildew resistant.
 - f. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - g. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Fabrication:
1. Select joints, seams, transitions, elbows, and branch connections and fabricate according to SMACNA's "Fibrous Glass Duct Construction Standards," Chapter 2, "Specifications and Closure," and Chapter 4, "Fittings and Connections."
 2. Fabricate 90-degree mitered elbows to include turning vanes.
 3. Reinforcements: Comply with requirements in SMACNA's "Fibrous Glass Duct Construction Standards," Chapter 5, "Reinforcement" for channel- and tie-rod reinforcement materials, spacing, and fabrication.
 4. Preformed Round Duct: Comply with NAIMA AH116, "Fibrous Glass Duct Construction Standards," Section VII, "Preformed Round Duct."

2.2 PHENOLIC-FOAM DUCTS AND FITTINGS

- A. Maximum performance parameters are static-pressure classes from minus 4- to plus 4-inch wg (minus 1000 to plus 1000 Pa), velocity up to 5000 fpm (25 m/s), and leakage class 6 cfm/100 sq. ft. at 1-inch wg (0.29 L/s per sq. m at 250 Pa) with all joints sealed.
- B. Duct Panel: CFC-free phenolic-foam bonded on both sides with factory-applied 0.001-inch-thick, aluminum foil reinforced with fiberglass scrim.
1. Maximum Temperature: 158 deg F inside ducts or ambient temperature surrounding ducts.
 2. Maximum Thermal Conductivity: 0.13 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 3. Permeability: 0.0002 perms maximum when tested according to ASTM E 96/E 96M, Procedure A.
 4. Antimicrobial Agent: Compound shall be tested for efficacy by an NRTL, and registered by the EPA for use in HVAC systems.
 5. Noise-Reduction Coefficient: 0.65 minimum when tested according to ASTM C 423, Mounting A.
 6. Required Markings: UL label and other markings required by UL 181 on each full sheet of duct panel; UL ratings for closure materials.
- C. Closure Materials:
1. V-Groove Adhesive: Silicone.
 - a. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
 2. Pressure-Sensitive Tape: Comply with UL 181A; imprinted by the manufacturer with the coding "181A-P," the manufacturer's name, and a date code.
 - a. Tape: Aluminum foil tape imprinted with listing information.
 - b. Minimum Tape Width: 3 inches.
 - c. Water resistant.
 - d. Mold and mildew resistant.
 3. Polymeric Sealing System:
 - a. Structural Membrane: Woven glass fiber.

- b. Minimum Tape Width: 3 inches.
 - c. Sealant: Water based.
 - d. Color: White.
 - e. Water resistant.
 - f. Mold and mildew resistant.
 - g. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - h. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
 - D. Fabrication:
 - 1. Fabricate joints, seams, transitions, reinforcement, elbows, branch connections, access doors and panels, and damage repairs according to Knauf Insulation's "Knauf KoolDuct System Design Guide," Section 4, "Duct Construction," and Section 5, "Ductwork System General."
 - 2. Fabricate 90-degree mitered elbows to include turning vanes.
- 2.3 HANGERS AND SUPPORTS
- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
 - B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
 - C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
 - D. Steel Cables: ASTM A 603, galvanized steel with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
 - E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
 - F. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.

PART 3 - EXECUTION

- 3.1 DUCT INSTALLATION
- A. Install ducts with fewest possible joints.
 - B. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
 - C. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
 - D. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
 - E. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges. Overlap openings on four sides by at least 1-1/2 inches.
 - F. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.
 - G. Protect duct interiors from the moisture, construction debris and dust, and other foreign materials.
 - H. Install fibrous-glass ducts and fittings to comply with SMACNA's "Fibrous Glass Duct Construction Standards."
 - I. Install foam ducts and fittings to comply with Knauf Insulation's "Knauf KoolDuct System Design Guide."

3.2 HANGER AND SUPPORT INSTALLATION

- A. Install hangers and supports for fibrous-glass ducts and fittings to comply with SMACNA's "Fibrous Glass Duct Construction Standards," Chapter 6, "Hangers and Supports."
- B. Install hangers and supports for phenolic-foam ducts and fittings to comply with Knauf Insulation's "Knauf KoolDuct System Design Guide," Section 5, "Ductwork System General."
- C. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.3 START UP

- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.4 DUCT SCHEDULE

- A. Indoor Ducts and Fittings:
 - 1. Fibrous-Glass Rectangular Ducts and Fittings:
 - a. Minimum Flexural Rigidity: EI-475.
 - b. Minimum Board Thickness: 1 inch.
 - 2. Fibrous-Glass Round Ducts and Fittings:
 - a. Minimum Thickness: 1 inch.
 - 3. Phenolic-Foam Rectangular Ducts and Fittings:
 - a. Minimum Panel Thickness: 7/8 inch.
 - b. Aluminum Cladding: Minimum 0.025 inch thick.
- B. Outdoor Duct and Fittings:
 - 1. Phenolic-Foam Rectangular Ducts and Fittings:
 - a. Minimum Panel Thickness: 7/8 inch.
 - b. Aluminum Cladding: Minimum 0.032 inch thick.
 - c. Polymeric Sealing System: Coat ducts, including gang-nail couplings, grip flanges, and couplings.

END OF SECTION 23 31 16

SECTION 233300

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Backdraft and pressure relief dampers.
 - 2. Manual volume dampers.
 - 3. Fire dampers.
 - 4. Turning vanes.
 - 5. Duct-mounted access doors.
 - 6. Flexible connectors.
 - 7. Flexible ducts.
 - 8. Duct accessory hardware.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
 - 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control-damper installations.
 - d. Fire-damper installations, including sleeves; and duct-mounted access doors.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G60.
 - 2. Exposed-Surface Finish: Mill phosphatized.

- B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and exposed ducts.
- C. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- D. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. Copy this article and re-edit for each type of backdraft and pressure relief damper.
- B. Description: Gravity balanced.
- C. Maximum Air Velocity: 1000 fpm.
- D. Maximum System Pressure: 1-inch wg.
- E. Frame: Hat-shaped, 0.05-inch- thick, galvanized sheet steel, with welded corners or mechanically attached.
- F. Blades: Multiple single-piece blades, center pivoted, maximum 6-inch width, 0.025-inch- thick, roll-formed aluminum with sealed edges.
- G. Blade Action: Parallel.
- H. Blade Seals: Felt.
- I. Blade Axles:
 - 1. Material: Nonferrous metal.
 - 2. Diameter: 0.20 inch.
- J. Tie Bars and Brackets: Galvanized steel.
- K. Return Spring: Adjustable tension.
- L. Bearings: Steel ball or synthetic pivot bushings.
- M. Accessories:
 - 1. Adjustment device to permit setting for varying differential static pressure.
 - 2. Counterweights and spring-assist kits for vertical airflow installations.
 - 3. Electric actuators.
 - 4. Chain pulls.
 - 5. Screen Mounting: Front mounted in sleeve.
 - a. Sleeve Thickness: 20 gage minimum.
 - b. Sleeve Length: 6 inches minimum.
 - 6. Screen Mounting: Rear mounted.
 - 7. Screen Material: Galvanized steel.
 - 8. Screen Type: Bird.
 - 9. 90-degree stops.

2.4 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
 - 1. Standard leakage rating.
 - 2. Suitable for horizontal or vertical applications.
 - 3. Frames:
 - a. Frame: Hat-shaped, 0.094-inch- thick, galvanized sheet steel.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
 - 4. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized-steel, 0.064 inch thick.
 - 5. Blade Axles: Galvanized steel.
 - 6. Bearings:
 - a. Oil-impregnated bronze.

- b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - 7. Tie Bars and Brackets: Galvanized steel.
 - B. Standard, Aluminum, Manual Volume Dampers:
 - 1. Standard leakage rating.
 - 2. Suitable for horizontal or vertical applications.
 - 3. Frames: Hat-shaped, 0.10-inch- thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
 - 4. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet.
 - e. Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum.
 - 5. Blade Axles: Galvanized steel.
 - 6. Bearings:
 - a. Oil-impregnated bronze.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - 7. Tie Bars and Brackets: Aluminum.
 - C. Jackshaft:
 - 1. Size: 0.5-inch diameter.
 - 2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 - 3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.
 - D. Damper Hardware:
 - 1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
 - 2. Include center hole to suit damper operating-rod size.
 - 3. Include elevated platform for insulated duct mounting.
- 2.5 FIRE DAMPERS
 - A. Type: Static and dynamic; rated and labeled according to UL 555 by an NRTL.
 - B. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.
 - C. Fire Rating: 1-1/2 hours.
 - D. Frame: Curtain type with blades inside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.
 - E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
 - 1. Minimum Thickness: 0.05 thick, as indicated, and of length to suit application.
 - 2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
 - F. Mounting Orientation: Vertical or horizontal as indicated.
 - G. Blades: Roll-formed, interlocking, 0.024-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
 - H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
 - I. Heat-Responsive Device: Replaceable, 212 deg F rated, fusible links.
 - J. Heat-Responsive Device: , replaceable link and switch package, factory installed, 212 deg F rated.
- 2.6 DUCT-MOUNTED ACCESS DOORS
 - A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
 - 1. Door:

- a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
 - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 - 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches.
 - d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.
 - B. Pressure Relief Access Door:
 - 1. Door and Frame Material: Galvanized sheet steel.
 - 2. Door: Single wall with metal thickness applicable for duct pressure class.
 - 3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
 - 4. Factory set at 3.0- to 8.0-inch wg.
 - 5. Doors close when pressures are within set-point range.
 - 6. Hinge: Continuous piano.
 - 7. Latches: Cam.
 - 8. Seal: Neoprene or foam rubber.
 - 9. Insulation Fill: 1-inch- thick, fibrous-glass or polystyrene-foam board.
- 2.7 DUCT ACCESS PANEL ASSEMBLIES
- A. Retain this article for access panels in fire-rated duct systems, such as exhaust ducts for commercial kitchen hoods.
 - B. Labeled according to UL 1978 by an NRTL.
 - C. Panel and Frame: Minimum thickness 0.0528-inch carbon steel.
 - D. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.
 - E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.
 - F. Minimum Pressure Rating: 10-inch wg, positive or negative.
- 2.8 FLEXIBLE CONNECTORS
- A. Materials: Flame-retardant or noncombustible fabrics.
 - B. Coatings and Adhesives: Comply with UL 181, Class 1.
 - C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
 - D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd..
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F.
 - E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - 1. Minimum Weight: 24 oz./sq. yd..
 - 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
 - 3. Service Temperature: Minus 50 to plus 250 deg F.
- 2.9 FLEXIBLE DUCTS
- A. UL 181 defines two categories of flexible ducts. Ducts listed according to UL 181 must pass all UL 181 tests. Air connectors listed according to UL 181 must pass most, but not all, UL 181 tests and are limited to lengths of 14 feet (4.3 m) or less.

- B. Noninsulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.
 - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 10 to plus 160 deg F.
 - C. Insulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
 - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 20 to plus 210 deg F.
 - 4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.
 - D. Flexible Duct Connectors:
 - 1. Clamps: Nylon strap in sizes 3 through 18 inches, to suit duct size.
 - 2. Non-Clamp Connectors: Adhesive.
- 2.10 DUCT ACCESSORY HARDWARE
- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
 - B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
 - 2. Install aluminum volume dampers in aluminum ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire dampers according to UL listing.
- H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils.
 - 2. Upstream from duct filters.
 - 3. At outdoor-air intakes and mixed-air plenums.
 - 4. At drain pans and seals.
 - 5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 - 6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream

- from dampers and inward operation for access doors installed downstream from dampers.
 - 7. At each change in direction and at maximum 50-foot spacing.
 - 8. Upstream from turning vanes.
 - 9. Upstream or downstream from duct silencers.
 - 10. Control devices requiring inspection.
 - 11. Elsewhere as indicated.
 - I. Install access doors with swing against duct static pressure.
 - J. Access Door Sizes:
 - 1. One-Hand or Inspection Access: 8 by 5 inches.
 - 2. Two-Hand Access: 12 by 6 inches.
 - 3. Head and Hand Access: 18 by 10 inches.
 - 4. Head and Shoulders Access: 21 by 14 inches.
 - 5. Body Access: 25 by 14 inches.
 - 6. Body plus Ladder Access: 25 by 17 inches.
 - K. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
 - L. Install flexible connectors to connect ducts to equipment.
 - M. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.
 - N. Connect diffusers or light troffer boots to ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.
 - O. Connect flexible ducts to metal ducts with adhesive.
 - P. Install duct test holes where required for testing and balancing purposes.
- 3.2 FIELD QUALITY CONTROL
- A. Tests and Inspections:
 - 1. Operate dampers to verify full range of movement.
 - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 - 3. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
 - 4. Inspect turning vanes for proper and secure installation.

END OF SECTION 23 33 00

SECTION 233423

HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Ceiling-mounted ventilators.
 - 2. In-line centrifugal fans.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.
 - 3. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
 - 4. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.
- C. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.1 CEILING-MOUNTED VENTILATORS

- A. These units are factory assembled with one or more centrifugal wheels up to 12 inches (300 mm) wide, directly connected to motor, enclosed in housing, with inlet grille and integral backdraft damper; AMCA rated.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Loren Cook Company
 - a. Any substitutions must be compliant with Build America, Buy America (BABA).
- C. Housing: Steel, lined with acoustical insulation.
- D. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.
- E. Grille: Plastic, louvered grille with flange on intake and thumbscrew attachment to fan housing.
- F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

- G. Accessories:
 - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - 2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
 - 3. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.
 - 4. Motion Sensor: Motion detector with adjustable shutoff timer.
 - 5. Ceiling Radiation Damper: Fire-rated assembly with ceramic blanket, stainless-steel springs, and fusible link.
 - 6. Filter: Washable aluminum to fit between fan and grille.
 - 7. Isolation: Rubber-in-shear vibration isolators.
 - 8. Manufacturer's standard roof jack or wall cap, and transition fittings.

2.2 IN-LINE CENTRIFUGAL FANS

- A. These fans are both belt driven and direct drive, usually with spun-aluminum housings, and are used for small ventilation requirements.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Acme Engineering & Manufacturing Corp.
 - 2. Carnes Company.
 - 3. Greenheck Fan Corporation.
 - 4. Loren Cook Company.
 - 5. PennBarry.
- C. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
- D. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.
- E. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.
- F. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.
- G. Accessories:
 - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - 2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
 - 3. Companion Flanges: For inlet and outlet duct connections.
 - 4. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
 - 5. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.

2.3 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- B. Enclosure Type: Totally enclosed, fan cooled.

2.4 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Equipment Mounting:
 - 1. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- B. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- C. Support suspended units from structure using threaded steel rods and elastomeric hangers having a static deflection of 1 inch. Vibration-control devices are specified in Section 230548.13 "Vibration Controls for HVAC."
- D. Install units with clearances for service and maintenance.
- E. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 5. Adjust belt tension.
 - 6. Adjust damper linkages for proper damper operation.
 - 7. Verify lubrication for bearings and other moving parts.
 - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 - 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 - 10. Shut unit down and reconnect automatic temperature-control operators.
 - 11. Remove and replace malfunctioning units and retest as specified above.
- C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

END OF SECTION 23 34 23

SECTION 233713

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Rectangular and square ceiling diffusers.
 - 2. Fixed face registers and grilles.
- B. Related Sections:
 - 1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.
- B. Samples: For each exposed product and for each color and texture specified.

1.3 QUALITY ASSURANCE

- A. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

- A. Rectangular and Square Ceiling Diffusers:
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Anemostat Products; a Mestek company.

2.2 REGISTERS AND GRILLES

- A. Fixed Face Register:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Anemostat Products; a Mestek company.
 - 2. Material: Steel.
 - 3. Finish: Baked enamel, white.
 - 4. Frame: 1-1/4 inches wide.
 - 5. Mounting: Countersunk screw.
 - 6. Damper Type: Adjustable opposed blade.
- B. Fixed Face Grille:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Anemostat Products; a Mestek company.
 - 2. Material: Steel.

3. Finish: Baked enamel, white.
4. Frame: 1-1/4 inches wide.
5. Mounting Frame: Filter.
6. Mounting: Countersunk screw.
7. Accessory: Filter.

2.3 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.2 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 37 13

SECTION 235416.13 - GAS-FIRED FURNACES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Gas-fired, noncondensing furnaces and accessories complete with controls.
2. Air filters.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Include diagrams for power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace the following components of furnaces that fail in materials or workmanship within specified warranty period:

1. Warranty Period, Commencing on Date of Substantial Completion:
 - a. Furnace Heat Exchanger: 20 years.
 - b. Integrated Ignition and Blower Control Circuit Board: Five years.
 - c. Draft-Inducer Motor: Five years.

1.5 QUALITY ASSURANCE

A. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a qualified testing agency, and marked for intended location and application.
- B. General Requirements for Noncondensing Gas-Fired Furnaces: Factory assembled, piped, wired, and tested; complying with ANSI Z21.47/CSA 2.3 and NFPA 54.

2.2 GAS-FIRED FURNACES, NONCONDENSING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Goodman Manufacturing Company, L.P.
- B. Cabinet:
 - 1. Cabinet interior around heat exchanger shall be factory-installed insulation.
 - 2. Lift-out panels shall expose burners and all other items requiring access for maintenance.
 - 3. Factory paint external cabinets in manufacturer's standard color.
 - 4. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- C. Fan: Centrifugal, factory balanced, resilient mounted, direct drive.
 - 1. Fan Motors: Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - 2. Special Motor Features, Single Speed: Single speed, premium efficiency, as defined in Section 230513 "Common Motor Requirements for HVAC Equipment," and with internal thermal protection and permanent lubrication.
 - 3. Special Motor Features, Multispeed: Multitapped, multispeed with internal thermal protection and permanent lubrication.
 - 4. Special Motor Features, ECM: Electronically controlled motor (ECM) controlled by integrated furnace/blower control.
- D. Type of Gas: Natural
- E. Heat Exchanger: Stainless steel.
- F. Burner:
 - 1. Gas Valve: 100 percent safety two-stage main gas valve, main shutoff valve, pressure regulator, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board.
 - 2. Ignition: Electric pilot ignition, with hot-surface igniter or electric spark ignition.
- G. Gas-Burner Safety Controls:

1. Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.
 2. Flame Rollout Switch: Installed on burner box; prevents burner operation.
 3. Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.
- H. Combustion-Air Inducer: Centrifugal fan with thermally protected motor and sleeve bearings prepurges heat exchanger and vents combustion products; pressure switch prevents furnace operation if combustion-air inlet or flue outlet is blocked.
- I. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; and adjustable fan-on and fan-off timing; terminals for connection to accessories.
- J. Vent Materials: Comply with requirements in Section 235123 "Gas Vents" for Type B metal vents.
- K. Capacities and Characteristics:
1. Reference Drawing Schedules.

2.3 GAS-FIRED FURNACES, CONDENSING

- A. Cabinet: Galvanized steel.
1. Cabinet interior around heat exchanger shall be factory-installed insulation.
 2. Lift-out panels shall expose burners and all other items requiring access for maintenance.
 3. Factory paint external cabinets in manufacturer's standard color.
 4. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- B. Fan: Centrifugal, factory balanced, resilient mounted, direct drive.
1. Fan Motors: Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."
 2. Special Motor Features, Single Speed: Single speed, premium efficiency, as defined in Section 230513 "Common Motor Requirements for HVAC Equipment," and with internal thermal protection and permanent lubrication.
 3. Special Motor Features, Multispeed: Multitapped, multispeed with internal thermal protection and permanent lubrication.
 4. Special Motor Features, ECM: Electronically controlled motor (ECM) controlled by integrated furnace/blower control.
- C. Type of Gas: Natural.
- D. Heat Exchanger:
1. Primary: Stainless steel.
 2. Secondary: Stainless steel.
- E. Burner:

1. Gas Valve: 100 percent safety two-stage main gas valve, main shutoff valve, pressure regulator, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board.
 2. Ignition: Electric pilot ignition, with hot-surface igniter or electric spark ignition.
- F. Gas-Burner Safety Controls:
1. Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.
 2. Flame Rollout Switch: Installed on burner box; prevents burner operation.
 3. Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.
- G. Combustion-Air Inducer: Centrifugal fan with thermally protected motor and sleeve bearings prepurges heat exchanger and vents combustion products; pressure switch prevents furnace operation if combustion-air inlet or flue outlet is blocked.
- H. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; adjustable fan-on and fan-off timing; terminals for connection to accessories.
- I. Accessories:
1. Combination Combustion-Air Intake and Vent: PVC plastic fitting to combine combustion-air inlet and vent through exterior.
 2. CPVC Plastic Vent Materials:
 - a. CPVC Plastic Pipe: Schedule 40, complying with ASTM F441/F441M.
 - b. CPVC Plastic Fittings: Schedule 40, complying with ASTM F438, socket type.
 - c. CPVC Solvent Cement: ASTM F493.
 - 1) [<Double click to insert sustainable design text for solvent cement.>](#)
 - 2) [<Double click to insert sustainable design text for adhesive.>](#)
 3. PVC Plastic Vent Materials:
 - a. PVC Plastic Pipe: Schedule 40, complying with ASTM D1785.
 - b. PVC Plastic Fittings: Schedule 40, complying with ASTM D2466, socket type.
 - c. PVC Solvent Cement: ASTM D2564.
 - 1) [<Double click to insert sustainable design text for adhesive primer.>](#)
 - 2) [<Double click to insert sustainable design text for solvent cement.>](#)
 - 3) [<Double click to insert sustainable design text for adhesive primer.>](#)
 - 4) [<Double click to insert sustainable design text for adhesive.>](#)
- J. Capacities and Characteristics:
1. See Drawing Schedules.

2.4 THERMOSTATS

- A. Controls shall comply with requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air Conditioning."
- B. Solid-State Thermostat: Wall-mounted, programmable, microprocessor-based unit with automatic switching from heating to cooling, preferential rate control, seven-day programmability with minimum of four temperature presets per day, and battery backup protection against power failure for program settings.
- C. Single-Stage, Heating-Cooling Thermostat: Adjustable, heating-cooling, wall-mounted unit with fan on-automatic selector.
- D. Two-Stage, Heating-Cooling Thermostat: Adjustable, heating-cooling, wall-mounted unit with fan on-automatic selector.

2.5 AIR FILTERS

- A. Disposable Filters: 1-inch thick fiberglass media with ASHRAE 52.2 MERV rating of 6 or higher, in sheet metal frame.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install gas-fired furnaces and associated fuel and vent features and systems according to NFPA 54.
- B. Suspended Units: Suspend from structure using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.
- C. Base-Mounted Units: Secure units to substrate. Provide optional bottom closure base if required by installation conditions.
- D. Controls: Install thermostats and humidistats at mounting height of 60 inches above floor.
- E. Wiring Method: Install control wiring in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal control wiring except in unfinished spaces.

3.2 PIPING CONNECTIONS

- A. Gas piping installation requirements are specified in Section 231123 "Facility Natural-Gas Piping." Drawings indicate general arrangement of piping, fittings, and specialties. Connect gas piping with union or flange and appliance connector valve.
- B. Install piping adjacent to equipment to allow service and maintenance.

- C. Water piping installation requirements are specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties. Connect water piping with union and ball valve.
- D. Vent Connection, Noncondensing, Gas-Fired Furnaces: Connect Type B vents to furnace vent connection and extend outdoors. Type B vents and their installation requirements are specified in Section 235123 "Gas Vents."
- E. Vent and Outside-Air Connection, Condensing, Gas-Fired Furnaces: Connect plastic piping vent material to furnace connections and extend outdoors. Terminate vent outdoors with a cap and in an arrangement that will protect against entry of birds, insects, and dirt.
 - 1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 - 2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 - 3. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - a. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. CPVC Piping: Join according to ASTM D2846/D2846M, Appendix.
 - c. PVC Pressure Piping: Join schedule number ASTM D1785PVC pipe and PVC socket fittings according to ASTM D2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D2855.
 - 4. Slope pipe vent back to furnace or to outside terminal.

3.3 DUCTWORK CONNECTIONS

- A. Connect ducts to furnace with flexible connector. Comply with requirements in Section 233300 "Air Duct Accessories."

3.4 ELECTRICAL CONNECTIONS

- A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."

2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.5 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

3.6 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. Perform electrical test and visual and mechanical inspection.
 2. Leak Test: After installation, charge systems with refrigerant and test for leaks. Repair leaks, replace lost refrigerant, and retest until no leaks exist.
 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.
 4. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
 5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

END OF SECTION 235416.13

SECTION 237416 - PACKAGED ROOFTOP AIR-CONDITIONING UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes packaged rooftop air conditioning units (RTUs) with the following components:
 - 1. Casings.
 - 2. Fans, drives, and motors.
 - 3. Coils.
 - 4. Refrigerant circuit components.
 - 5. Air filtration.
 - 6. Gas furnaces.
 - 7. Dampers.
 - 8. Electrical power connections.
 - 9. Controls.
 - 10. Roof curbs.
 - 11. Accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of RTU.
- B. Shop Drawings: For each packaged rooftop air-conditioning units.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.
- C. Delegated-Design Submittal: For RTU supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Include design calculations for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - 2. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
 - 3. Wind- and Seismic-Restraint Details: Detail fabrication and attachment of wind and seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans and other details, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.
- B. Sample Warranty: For manufacturer's warranty.
- C. Seismic Qualification Data: Certificates, for RTUs, accessories, and components, from manufacturer.
- D. Source quality-control reports.
- E. System startup reports.
- F. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BAB).

1.6 WARRANTY

- A. Warranty: Manufacturer agrees to repair or replace components of outdoor, semi-custom, air-handling unit that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 5 year(s) from date of Substantial Completion.
 - 2. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than five years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of RTUs and components.

- C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- D. ASHRAE 15 Compliance: For refrigeration system safety.
- E. UL Compliance: Comply with UL 1995.

2.2 CAPACITIES AND CHARACTERISTICS

- A. Reference HVAC Replacement Schedule for unit capacities.

2.3 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AAON.

2.4 UNIT CASINGS

- A. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.
- B. Double-Wall Construction:
 - 1. Outside Casing Wall: Galvanized steel, minimum 18 gauge thick with manufacturer's standard finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
 - 2. Inside Casing Wall: G90-coated galvanized steel, 0.034 inch thick.
 - 3. Floor Plate: G90 galvanized steel, minimum 18 gauge thick.
 - 4. Casing Insulation:
 - a. Materials: Injected polyurethane foam insulation.
 - b. Insulation Thickness: 2 inches.
 - c. Thermal Break: Provide continuity of insulation with no through-casing metal in casing walls, floors, or roof of unit.
- C. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.
- D. Static-Pressure Classifications:
 - 1. For Unit Sections Upstream of Fans: Minus 2-inch wg.
 - 2. For Unit Sections Downstream and Including Fans: 2-inch wg.
- E. Panels and Doors:
 - 1. Panels:

- a. Fabrication: Formed and reinforced with same materials and insulation thickness as casing.
 - b. Fasteners: Two or more camlock type for panel lift-out operation. Arrangement shall allow panels to be opened against air-pressure differential.
 - c. Gasket: Neoprene, applied around entire perimeters of panel frames.
 - d. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components. Dimensions to be at least 24 inches wide by full height of unit casing up to a maximum height of 60 inches.
2. Access Doors:
 - a. Hinges: A minimum of two ball-bearing hinges or stainless steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.
 - b. Gasket: Neoprene, applied around entire perimeters of panel frames.
 - c. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components. Dimensions to be at least 18 inches wide by full height of unit casing up to a maximum height of 60 inches.
3. Locations and Applications:
 - a. Fan Section: Doors.
 - b. Access Section: Doors.
 - c. Coil Section: Inspection and access panels.
 - d. Damper Section: Inspection and access panels.
 - e. Filter Section: Doors large enough to allow periodic removal and installation of filters.
 - f. Mixing Section: Doors.
4. Service Light: 100-W vaporproof fixture with switched junction box located outside adjacent to door.
 - a. Locations: Fan section.

F. Condensate Drain Pans:

1. Location: Each type of cooling coil.
2. Construction:
 - a. Single-wall, stainless steel sheet.
3. Drain Connection:
 - a. Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
 - b. Minimum Connection Size: NPS 1.
4. Slope: Minimum 0.125-in./ft. slope, to comply with ASHRAE 62.1, in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and from humidifiers and to direct water toward drain connection.
5. Length: Extend drain pan downstream from leaving face.

6. Width: Entire width of water producing device.
7. Depth: A minimum of 2 inches deep.
8. Pan-Top Surface Coating for Galvanized-Steel Drain Pans: Asphaltic waterproofing compound.
9. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

2.5 FANS, DRIVES, AND MOTORS

- A. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.
- B. Supply-Air Fans: Centrifugal, rated according to AMCA 210; galvanized or painted steel; mounted on solid-steel shaft.
 1. Shafts: With field-adjustable alignment.
 - a. Turned, ground, and polished hot-rolled steel with keyway.
 2. Shaft Bearings:
 - a. Heavy-duty, self-aligning, pillow-block type with an L-50 rated life of minimum 100,000 hours according to ABMA 9.
 3. Housings: Formed- and reinforced-steel panels to form curved scroll housings with shaped cutoff and spun-metal inlet bell.
 - a. Bracing: Steel angle or channel supports for mounting and supporting fan scroll, wheel, motor, and accessories.
 4. Centrifugal Fan Wheels: Inlet flange, backplate, and shallow blades with inlet and tip curved forward in direction of airflow and mechanically fastened to flange and backplate; steel or aluminum hub swaged to backplate and fastened to shaft with setscrews.
 5. Mounting: For internal vibration isolation. Factory-mount fans with manufacturer's standard restrained vibration isolation mounting devices having a minimum static deflection of 1 inch.
 6. Shaft Lubrication Lines: Extended to a location outside the casing.
 7. Flexible Connector: Factory fabricated with a fabric strip minimum 3-1/2 inches wide, attached to two strips of minimum 2-3/4-inch-wide by 0.028-inch-thick, galvanized-steel sheet.
 - a. Flexible Connector Fabric: Glass fabric, double coated with neoprene. Fabrics, coatings, and adhesives shall comply with UL 181, Class 1.
- C. Drives, Direct: Factory-mounted, direct drive.
- D. Drives, Belt: Factory-mounted, V-belt drive, with adjustable alignment and belt tensioning, and with 1.5 service factor based on fan motor.

1. Pulleys: Cast iron or cast steel with split, tapered bushing, dynamically balanced at the factory.
 2. Belts: Oil resistant, non-sparking and nonstatic; in matched sets for multiple-belt drives.
 3. Belt Guards: Comply with requirements specified by OSHA and fabricate according to SMACNA's "HVAC Duct Construction Standards"; 0.146-inch- thick, 3/4-inch diamond-mesh wire screen, welded to steel angle frame; prime coated.
- E. Condenser-Coil Fan: Variable-speed propeller, mounted on shaft of permanently lubricated ECM motors.
- F. Motors:
1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 2. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 3. Enclosure Type: Open, dripproof.
 4. Efficiency: Premium efficient as defined in NEMA MG 1.
 5. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.

2.6 COILS

A. General Requirements for Coils:

1. Comply with AHRI 410.
2. Fabricate coils section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
3. Coils shall not act as structural component of unit.

B. Supply-Air Refrigerant Coil:

1. Tubes: Copper.
2. Fins:
 - a. Material: Aluminum.
 - b. Fin Spacing: Maximum 12 fins per inch.
3. Fin and Tube Joints: Mechanical bond.
4. Headers: Seamless-copper headers with brazed connections.
5. Frames: Stainless steel.
6. Ratings: Designed, tested, and rated according to ASHRAE 33 and AHRI 410.
 - a. Working Pressure: Minimum 300 psig.

2.7 REFRIGERANT CIRCUIT COMPONENTS

A. Number of Refrigerant Circuits: Two.

- B. Compressor: Hermetic, variable speed scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater.
- C. Refrigeration Specialties:
 - 1. Refrigerant: R-32 or R-454B.
 - 2. Expansion valve with replaceable thermostatic element.
 - 3. Refrigerant filter/dryer.
 - 4. Manual-reset high-pressure safety switch.
 - 5. Automatic-reset low-pressure safety switch.
 - 6. Minimum off-time relay.
 - 7. Automatic-reset compressor motor thermal overload.
 - 8. Brass service valves installed in compressor suction and liquid lines.
 - 9. Low-ambient kit high-pressure sensor.
 - 10. Four-way reversing valve with a replaceable magnetic coil, thermostatic expansion valves with bypass check valves, and a suction line accumulator.

2.8 AIR FILTRATION

- A. Particulate air filtration is specified in Section 234100 "Particulate Air Filtration."
- B. Panel Filters:
 - 1. Description: Flat, non-pleated factory-fabricated, self-supported, disposable air filters with holding frames.
 - 2. Filter Unit Class: UL 900.
 - 3. Media: Interlaced glass, synthetic or cotton fibers coated with nonflammable adhesive and antimicrobial coating.
 - 4. Filter-Media Frame: Beverage board with perforated metal retainer, or metal grid, on outlet side.

2.9 GAS FURNACES

- A. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47/CSA 2.3 and NFPA 54.
- B. CSA Approval: Designed and certified by and bearing label of CSA.
- C. Burners: Stainless steel.
 - 1. Fuel: Natural gas.
 - 2. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.
 - 3. Gas Control Valve: Two stage.
 - 4. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.
- D. Heat-Exchanger and Drain Pan: Stainless steel.
- E. Venting, Gravity: Gravity vented.

F. Safety Controls:

1. Gas Manifold: Safety switches and controls complying with ANSI standards.

2.10 DAMPERS

- A. Outdoor- and Return-Air Dampers: Low-leakage, double-skin, airfoil-blade, galvanized-steel dampers with compressible jamb seals and extruded-vinyl blade edge seals in opposed-blade arrangement with zinc-plated steel operating rods rotating in sintered bronze or nylon bearings mounted in a single galvanized-steel frame, and with operating rods connected with a common linkage. Leakage rate shall not exceed 4 cfm/sq. ft. at 1-inch wg and 8 cfm/sq. ft. at 4-inch wg
- B. Barometric relief dampers.
- C. Electronic Damper Operators:
1. Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
 2. Electronic damper position indicator shall have visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
 3. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
 4. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.
 5. Size dampers for running torque calculated as follows:
 - a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
 - b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
 - c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft. of damper.
 - d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
 - e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
 - f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.
 6. Coupling: V-bolt and V-shaped, toothed cradle.
 7. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
 8. Fail-Safe Operation: Mechanical, spring-return mechanism with external, manual gear release on nonspring-return actuators.
 9. Power Requirements (Two-Position Spring Return): 24 V dc.
 10. Power Requirements (Modulating): Maximum 10 VA at 24 V ac or 8 W at 24 V dc.
 11. Proportional Signal: 2 to 10 V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
 12. Temperature Rating: Minus 22 to plus 122 deg F.
 13. Run Time: 30 seconds.

2.11 ELECTRICAL POWER CONNECTIONS

- A. RTU shall have a single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

2.12 CONTROLS

A. Basic Unit Controls:

1. Control-voltage transformer.
2. Wall-mounted thermostat or sensor with the following features:
 - a. Heat-cool-off switch.
 - b. Fan on-auto switch.
 - c. Fan-speed switch.
 - d. Automatic changeover.
 - e. Adjustable deadband.
 - f. Concealed set point.
 - g. Exposed indication.
 - h. Degree F indication.
 - i. Unoccupied-period-override push button.
 - j. Data entry and access port to input temperature set points, occupied and unoccupied periods, and output room temperature, supply-air temperature, operating mode, and status.

2.13 ROOF CURBS

- ### A. Roof curbs with vibration isolators and wind or seismic restraints are specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- ### B. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.
1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
 - a. Materials: ASTM C 1071, Type I or II.
 - b. Thickness: 1-1/2 inches.
 2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
 - a. Liner Adhesive: Comply with ASTM C916, Type I.
 - b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
 - c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
 - d. Liner Adhesive: Comply with ASTM C916, Type I.
- ### C. Curb Dimensions: Height of 14 inches.

2.14 ACCESSORIES

- A. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required.
- B. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.
- C. Remote potentiometer to adjust minimum economizer damper position.
- D. Return-air bypass damper.
- E. Safeties:
 - 1. Smoke detector.
 - 2. Condensate overflow switch.
 - 3. Gas furnace airflow-proving switch.
- F. Coil guards of painted, galvanized-steel wire.
- G. Hail guards of galvanized steel, painted to match casing.
- H. Outdoor air intake weather hood.

2.15 MATERIALS

- A. Steel:
 - 1. ASTM A36/A36M for carbon structural steel.
 - 2. ASTM A568/A568M for steel sheet.
- B. Stainless Steel:
 - 1. Manufacturer's standard grade for casing.
 - 2. Manufacturer's standard type, ASTM A240/A240M for bare steel exposed to airstream or moisture.
- C. Galvanized Steel: ASTM A653/A653M.
- D. Aluminum: ASTM B209.
- E. Comply with Section 230546 "Coatings for HVAC" for corrosion-resistant coating.
- F. Corrosion-Resistant Coating: Coat with a corrosion-resistant coating capable of withstanding a 3000-hour salt-spray test according to ASTM B117.
 - 1. Standards:
 - a. ASTM B117 for salt spray.
 - b. ASTM D2794 for minimum impact resistance of 100 in-lb.
 - c. ASTM B3359 for cross-hatch adhesion of 5B.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.
- B. Roof Curb: Install on roof structure or concrete base, level and secure, according to NRCA's "NRCA Roofing Manual: Membrane Roof Systems." Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction. Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts. Coordinate sizes and locations of roof curbs with actual equipment provided.
- C. Unit Support: Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.

3.2 PIPING CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to RTU, allow space for service and maintenance.
- C. Connect piping to unit mounted on vibration isolators with flexible connectors.
- D. Connect condensate drain pans using NPS 1-1/4, ASTM B88, Type M copper tubing. Extend to nearest equipment or roof drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.
- E. Gas Piping: Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.
- F. Refrigerant Piping: Install shutoff valve and union or flange at each supply and return connection.

3.3 DUCT CONNECTIONS

- A. Comply with duct installation requirements specified in other HVAC Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
 - 1. Install ducts to termination at top of roof curb.
 - 2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
 - 3. Connect supply ducts to RTUs with flexible duct connectors.
 - 4. Install return-air duct continuously through roof structure.

3.4 ELECTRICAL CONNECTIONS

- A. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
- B. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate shall be laminated acrylic or melamine plastic signs as layers of black with engraved white letters at least 1/2 inch high.
 - 2. Locate nameplate where easily visible.

3.5 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform the following tests and inspections:
 - 1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
 - 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. RTU will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain RTUs.

END OF SECTION 237416.13

SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Product Data for Credit EA 4: Documentation indicating that equipment and refrigerants comply.
 - 2. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1.3 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance:
 - 1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
 - 2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Procedures," and Section 7 - "Construction and System Start-up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.
- D. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period:
 - a. For Compressor: Five year(s) from date of Substantial Completion.
 - b. For Parts: Five year(s) from date of Substantial Completion.
 - c. For Labor: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Goodman Mfg.

2.2 INDOOR UNITS (5 TONS OR LESS)

A. Concealed Evaporator-Fan Components:

1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
2. Insulation: Faced, glass-fiber duct liner.
3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
4. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.
5. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
6. Fan Motors:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
 - c. Wiring Terminations: Connect motor to chassis wiring with plug connection.
7. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
8. Filters: Permanent, cleanable.
9. Condensate Drain Pans:
 - a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
 - 1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
 - 2) Depth: A minimum of 2 inches deep.
 - b. Single-wall, galvanized-steel sheet.
 - c. Double-wall, galvanized-steel sheet with space between walls filled with foam insulation and moisture-tight seal.
 - d. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
 - 1) Minimum Connection Size: NPS 1.
 - e. Pan-Top Surface Coating: Asphaltic waterproofing compound.
 - f. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

B. Floor-Mounted, Evaporator-Fan Components:

1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect.
 - a. Discharge Grille: Steel with surface-mounted frame.
 - b. Insulation: Faced, glass-fiber duct liner.
 - c. Drain Pans: Galvanized steel, with connection for drain; insulated.
2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
3. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors,

- manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.
4. Fan: Direct drive, centrifugal.
 5. Fan Motors:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
 6. Air Filtration Section:
 - a. General Requirements for Air Filtration Section:
 - 1) Comply with NFPA 90A.
 - 2) Minimum Arrestance: According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.
 - 3) Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.
 - b. Disposable Panel Filters:
 - 1) Factory-fabricated, viscous-coated, flat-panel type.
 - 2) Thickness: 1 inch.
 - 3) Arrestance according to ASHRAE 52.1: 80.
 - 4) Merv according to ASHRAE 52.2: 5.
 - 5) Media: Interlaced glass fibers sprayed with nonflammable adhesive.
 - 6) Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, and hinged; with pull and retaining handles.
- C. Wall-Mounted, Evaporator-Fan Components:
1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.
 2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
 3. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.
 4. Fan: Direct drive, centrifugal.
 5. Fan Motors:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
 - c. Enclosure Type: Totally enclosed, fan cooled.
 - d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
 - e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
 - f. Mount unit-mounted disconnect switches on exterior of unit.
 6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 7. Condensate Drain Pans:
 - a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
 - 1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
 - 2) Depth: A minimum of 1 inch deep.
 - b. Single-wall, galvanized-steel sheet.
 - c. Double-wall, galvanized-steel sheet with space between walls filled with foam insulation and moisture-tight seal.

- d. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
 - 1) Minimum Connection Size: NPS 1.
- e. Pan-Top Surface Coating: Asphaltic waterproofing compound.
- 8. Air Filtration Section:
 - a. General Requirements for Air Filtration Section:
 - 1) Comply with NFPA 90A.
 - 2) Minimum Arrestance: According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.
 - 3) Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.
 - b. Disposable Panel Filters:
 - 1) Factory-fabricated, viscous-coated, flat-panel type.
 - 2) Thickness: 1 inch.
 - 3) Arrestance according to ASHRAE 52.1: 80.
 - 4) Merv according to ASHRAE 52.2: 5.
 - 5) Media: Interlaced glass fibers sprayed with nonflammable adhesive.
 - 6) Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, and hinged; with pull and retaining handles.

2.3 OUTDOOR UNITS (5 TONS OR LESS)

- A. Air-Cooled, Compressor-Condenser Components:
 - 1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
 - 2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - a. Compressor Type: Scroll.
 - b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
 - c. Refrigerant Charge: R-454B or R-32.
 - d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.
 - 3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
 - 4. Fan: Aluminum-propeller type, directly connected to motor.
 - 5. Motor: Permanently lubricated, with integral thermal-overload protection.
 - 6. Low Ambient Kit: Permits operation down to 45 deg F.
 - 7. Mounting Base: Polyethylene.

2.4 ACCESSORIES

- A. Thermostat: Low voltage with subbase to control compressor and evaporator fan.
- B. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:
 - 1. Compressor time delay.
 - 2. 24-hour time control of system stop and start.
 - 3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
 - 4. Fan-speed selection including auto setting.
- C. Automatic-reset timer to prevent rapid cycling of compressor.
- D. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
- E. Drain Hose: For condensate.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Install roof-mounted, compressor-condenser components on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.
- D. Equipment Mounting:
 - 1. Install ground-mounted, compressor-condenser components on polyethylene mounting base.
 - 2. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- E. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
 - 1. Water Coil Connections: Comply with requirements specified in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties." Section 15179 "Hydronic Piping Specialties." Connect hydronic piping to supply and return coil connections with shutoff-duty valve and union or flange on the supply connection and with throttling-duty valve and union or flange on the return connection.
 - 2. Remote, Water-Cooled Condenser Connections: Comply with requirements specified in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties." Section 15179 "Hydronic Piping Specialties." Connect hydronic piping to supply and return connections with shutoff-duty valve and union or flange on the supply connection and with throttling-duty valve and union or flange on the return connection.
- B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.
- C. Duct Connections: Duct installation requirements are specified in Section 233113 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 233300 "Air Duct Accessories."

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports.

3.4 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 23 81 26

SECTION 238219

FAN COIL UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes ductless fan coil units and accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Include diagrams for power, signal, and control wiring.
- C. Samples: For units with factory-applied color finishes.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale and coordinated with each other based on input from installers of the items involved:
- B. Seismic Qualification Certificates: For fan coil units, accessories, and components, from manufacturer.
- C. Field quality-control reports.
- D. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- D. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Factory-packaged and -tested units rated according to AHRI 440, ASHRAE 33, and UL 1995.

2.2 DUCTLESS FAN COIL UNITS

- A. Many additional features, which vary with each manufacturer, are available for this product. Include all features for fan coil units that are required for Project, and identify additional features for specific units in the Fan Coil Unit Schedule on Drawings.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. IEC (International Environmental Corporation); LSB Industries.
2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- C. Coil Section Insulation: Insulate coil section according to Section 230616 "HVAC Equipment Insulation."
 1. Surface-Burning Characteristics: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84 by a qualified testing agency.
 2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- D. Main and Auxiliary Drain Pans: Plastic. Fabricate pans and drain connections to comply with ASHRAE 62.1.
- E. Chassis: Galvanized steel where exposed to moisture, with baked-enamel finish and removable access panel. Floor-mounting units shall have leveling screws.
- F. Cabinet: Steel with baked-enamel finish in manufacturer's standard paint color as selected by Architect.
 1. Vertical Unit Front Panels: Removable, steel, with integral stamped discharge grille and channel-formed edges, cam fasteners, and insulation on back of panel.
 2. Horizontal Unit Bottom Panels: Fastened to unit with cam fasteners and hinge and attached with safety chain; with integral stamped discharge grilles.
 3. Stack Unit Discharge and Return Grille: Aluminum double-deflection discharge grille, and louvered- or panel-type return grille; color as selected by Architect from manufacturer's standard colors. Return grille shall provide maintenance access to fan coil unit.
 4. Steel recessing flanges for recessing fan coil units into ceiling or wall.
- G. Filters: Minimum arrestance and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2 and all addendums.
 1. MERV Rating: 6 when tested according to ASHRAE 52.2.
 2. Washable Foam: 70 percent arrestance and MERV 3.
- H. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with fuses in terminal box for overcurrent protection and limit controls for high-temperature protection. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.
- I. Fan and Motor Board: Removable.
 1. Fan: Forward curved, double width, centrifugal; directly connected to motor. Thermoplastic or painted-steel wheels, and aluminum, painted-steel, or galvanized-steel fan scrolls.
 2. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."
 3. Wiring Termination: Connect motor to chassis wiring with plug connection.
- J. Basic Unit Controls:
 1. Control voltage transformer.
 2. Wall-mounting thermostat with the following features:
 - a. Heat-cool-off switch.
 - b. Fan on-auto switch.
 - c. Fan-speed switch.
 - d. Automatic changeover.
 - e. Adjustable deadband.
 - f. Concealed set point.
 - g. Exposed indication.
 - h. Degree F indication.
- K. Electrical Connection: Factory wire motors and controls for a single electrical connection.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fan coil units level and plumb.
- B. Install fan coil units to comply with NFPA 90A.
- C. Verify locations of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches above finished floor.
- D. Install new filters in each fan coil unit within two weeks after Substantial Completion.
- E. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:
 - 1. Install piping adjacent to machine to allow service and maintenance.
 - 2. Connect piping to fan coil unit factory hydronic piping package. Install piping package if shipped loose.
 - 3. Connect condensate drain to indirect waste.
 - a. Install condensate trap of adequate depth to seal against fan pressure. Install cleanouts in piping at changes of direction.
- F. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- G. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
 - 3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace malfunctioning units and retest as specified above.
- C. Prepare test and inspection reports.

3.3 ADJUSTING

- A. Adjust initial temperature and humidity set points.
- B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

END OF SECTION 23 82 19

PART 1-GENERAL

1.1 RELATED DOCUMENTS

- A. Provisions of the General Conditions, Supplementary Conditions and Division 01 - General Requirements, and applicable provisions elsewhere in the Contract Documents apply to the work Division 26- Electrical.

1.2 SUMMARY OF WORK

- A. Provide all labor, materials, supervision, tools, services, equipment and incidentals necessary for complete and operational systems as specified under this division, as shown on the Contract Drawings or as required.

1.3 DRAWINGS AND SPECIFICATIONS

- A. Prior to submitting a bid:
 - 1. Examine the Drawings.
 - 2. Read the Specifications and other Contract Documents, including Addenda and referenced material.
 - 3. Visit the site of work.
 - 4. Become informed prior to bidding as to existing conditions and limitations of the project.
- B. Bring exceptions and inconsistencies in Drawings, specifications, addenda, referenced material, other Contract Documents and site conditions to the attention of the Architect in writing seven days before the bid opening; otherwise be responsible for changes and additions that become necessary during construction.
- C. Interpretation or correction of the Contract Documents will be made by Addendum and will be mailed or delivered to each Contract Bidder of Record.
- D. Location of material, equipment, devices and appliances shown in the Contract Drawings are approximate and are subject to such revisions as may be necessary or desirable at the time the work is installed. Install the work in relation to existing conditions and be responsible for the correctness of the work with reference to finish elevations and surrounding conditions.
- E. The Contract Documents show the general arrangements of work. Should project conditions require any rearrangement, or if equipment or accessories can be installed to better advantage in a different manner, the Contractor may, before proceeding with the work, prepare and submit five copies of shop drawings of the proposed rearrangement for the Architect's review.
- F. If the Contractor proposes to install equipment requiring space conditions other than those shown, he shall assume responsibility for the rearrangement of the space and shall have the Architect review the change before proceeding with the work. The request for such changes shall be accompanied by shop drawings of the space affected.
- G. The accompanying Drawings do not indicate the existing electrical installations other than to identify modifications to the extensions thereto. Visit the site and ascertain the conditions to be met and the work to be accomplished in removing and modifying the existing work, and installing the new work. Failure to comply with this shall not constitute grounds for any additional payment in connection with

removing or modifying any part of the existing installations and/or installing any new or temporary work under this Division.

1.4 CODES AND STANDARDS

- A. Execute the work in accordance with local, state and national codes, ordinances and regulations having jurisdiction or authority over the work. Make any and all adjustments required by these agencies without further cost to the Owner. In addition, conform to the applicable provisions and recommendations of the following standards:
1. National Electrical Manufacturer Association (NEMA)
 2. American Society for Testing and Materials (ASTM)
 3. National Fire Protection Association (NFPA)
 4. National Electrical Safety code (NESC)
 5. Institute of Electrical and Electronic Engineers (IEEE)
 6. National Electrical Code (NEC)
 7. Underwriters' Laboratories (UL)
 8. American National Standards Institute (ANSI)
 9. International Building Code (IBC)
 10. Occupational Safety and Health Administration (OSHA)
 11. Local utility companies
 12. Americans with Disabilities Act (ADA)
 13. City Codes and Amendments
 14. Texas Department of Aging and Disability Services (TxDADS)
- B. Execute the work in accordance with the most current codes and standards in effect at the time of bidding.
- C. In the event standards and codes conflict with each other, the most stringent shall apply.
- D. Conform to National Electrical Code rules, be listed approved by Underwriter's Laboratories, Inc. and acceptable by Factory Mutual.
- E. It is specifically understood, however, that in those instances where capacities sizes, etc., of electrical equipment, devices or material as designated in these Specifications or on the Drawings are in excess of the minimum requirements of the National Electrical Code, such designated capacities shall prevail.

1.5 JOB SITE

- A. Neither the professional activities of the DESIGN PROFESSIONAL, nor the presence of the DESIGN PROFESSIONAL or the DESIGN PROFESSIONAL's employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties, and responsibilities including, but not limited to, construction means, methods, sequences, techniques, or procedures necessary for performing, superintending, or coordinating all portions of the work construction in accordance with the contract documents and any health and safety precautions required by any regulatory agencies. The DESIGN PROFESSIONAL and DESIGN PROFESSIONAL's personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precaution.

PART 2 - PRODUCTS

2.1 SHOP DRAWINGS AND SUBMITTALS

- A. Submit Shop Drawings for all material furnished under this division of the work. Refer to the General Requirements for additional requirements. No material shall be fabricated, delivered to the job site, or installed which has not been reviewed by the Architect through Shop Drawing submittals.
- B. The submittals shall include sufficient descriptive material, such as catalog cuts, diagrams, and other data published by the manufacturer, as well as evidence of compliance with safety and performance standards, to demonstrate conformance to the specification requirements; catalog numbers alone will not be acceptable. The data shall include the name and address of the nearest service and maintenance organization that regularly stocks repair parts.
- C. Deliver Shop Drawings to the Architect in sufficient time to avoid delay of the project. Allow a minimum of one month for the Architect to review and return the submittals.
- D. Submit samples for review when requested by the Architect.
- E. Before submitting Shop Drawings for review, examine them and verify that they correctly represent the material or equipment intended for this project. The Contractor's review of Shop Drawings is not intended to take the place of the review of the Architect, and Shop Drawings which have not been reviewed by the Architect shall not be used in fabricating or installing any work.
- F. List deviations and exceptions from the specified equipment in writing. Failure to do so will be cause for rejection of submittals. Contractor agrees that if deviations discrepancies, or conflicts between Shop Drawings submittals and the Contract Documents are discovered either prior to or after Shop Drawings submittals are reviewed by the Architect, the Contract Documents shall control and shall be followed, unless deviations have been specifically approved by the Architect.
- G. The review of Shop Drawings or catalog data by the Architect shall not relieve the Contractor from responsibility for deviations from plans and specifications unless he has, in writing, specifically called attention to such deviations at the time of submission and has obtained the permission of the Architect thereon; nor shall it relieve him from responsibility for error of kind in Shop Drawings. When the Contractor does call such deviations to the attention of the Architect, he shall state in his letter whether or not such deviations involve any extra cost. If this is not mentioned, it will be assumed that no extra cost is involved for making the change.
- H. Contractor agrees that Shop Drawing submittals reviewed by the Architect are not change orders; that the purpose of Shop Drawing submittals by the Contractor is to demonstrate to the Architect that the Contractor understands the design concept, that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use.
- I. Electronic files of the construction documents will not be provided and may not be used for shop drawing submittals.

2.2 STANDARDS FOR MATERIALS

- A. It is the intention of these specifications to indicate a standard of quality for all materials incorporated in this work. Manufacturer's names and catalog numbers are used to designate the item of equipment or material as a means of establishing grade and quality. Where several manufacturers are named, only the named manufacturer's products will be considered and the Contractor's bid shall be based on their product.
- B. Where the phrase 'or approved equal' or 'or equal' or 'equal to' or 'accepted substitute' is used in these specifications, the names or name mentioned are to be used as a basis of quality. Other manufacturers will be considered if the quality of the proposed material is equal to that of materials named, in the opinion of the Architect. Such unnamed manufacturers' products will, however, be considered as substitutions and shall not be used as a basis for bidding.

- C. Basis of quality shall include material, workmanship, weight, finishes, gauges of material, appearances, capacity and performance. Manufacturer's representation as to availability of equipment, replacement parts and service personnel in the area will be a factor in consideration of submittals.
- D. All materials shall be fully warranted.
- E. Furnish standard products of manufacturers regularly engaged in production of such equipment.
- F. Furnish manufacturer's latest standard design.
- G. All equipment shall conform to the applicable IEEE, UL, ANSI, and/or NEMA Standards.
- H. Obtain manufacturer's recommendations and instructions for all installed equipment including installation instructions, preparation cleaning, tests, pre-service checks and ensure all have been performed prior to completion of work.

2.3 SUBSTITUTIONS

- A. Substitutions of equipment shall be approved by the Architect / Engineer prior to installation. Substitution of equipment shall be in accordance with Division 01 of the specifications.
- B. When alternate or substitute materials and equipment are used, the Contractor shall be responsible for space requirements, configurations, performance, changes in bases, supports, structural members and openings in structure, and other apparatus and trades that may be affected by their use.
- C. Contractor shall bear all additional costs resulting from the use of substituted materials. Such changes be at no additional cost to the Owner.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Coordinate and direct the work under this division of the specifications with the work under other divisions of the specifications. Examine the Contract Documents and report any discrepancies between divisions of the work to the Architect and obtain written instructions for changes necessary in the work.
- B. Before installation, make proper provisions to avoid interference's with the work under other divisions of the specifications. Changes required in the work of the Contractor caused by his neglect to do so shall be made by him at his own expense.
- C. Harmonize the work under this division with the work under other divisions of the specifications such that it may be installed in the most direct and workmanlike manner without hindering, handicapping, or conflicting with the work under other divisions of the specifications. Piping interference's shall be handled by giving precedence to pipelines which require a stated grade for proper operation.
- D. Install all work/equipment in accordance with manufacturer's installation instructions.

3.2 PERMITS AND FEES

- A. Secure and pay for all necessary permits, licenses and inspections required by law for the completion of the work. Secure and pay for all certificates of approval that are required and deliver them to the Architect before final acceptance of the work.
- B. If any charges are made by a utility company in connection with the work under this division, the Contractor shall advise the Owner, so that the Owner can pay these charges. Advise the Owner of these charges at the time of bid, so as not to delay construction on the project.

3.3 QUALITY ASSURANCE

- A. Use adequate quantities of skilled workmen who are trained and experienced in their crafts and who are familiar with the specified requirements and methods needed to perform the work in this division.
- B. Install materials and equipment based upon actual dimensions and conditions at the project site. Field measure for materials or equipment requiring exact fit.
- C. Properly located and size all slots, holes or openings in the building structure pertaining to the work in this division, and for the correct location of pipe sleeves.
- D. Perform work in accordance with good commercial practice. The good appearance of the finished work shall be of equal importance with its operation.
- E. Isolate all conduit, transformers and motors to insure an acceptable noise level free from objectionable vibration for all systems.

3.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Follow the manufacturer's directions in the delivery, storage and handling of equipment and materials.
- B. Equipment and materials shall be tightly covered and protected against dirt, water, chemical or mechanical injury and theft. Damaged equipment will not be accepted.
- C. After materials are installed, protect the installation until the work is completed and accepted by the Owner.

3.5 CLEANING UP

- A. Remove all shipping labels, dirt, paint, grease and stains from all equipment under this division of the work. Remove debris as it accumulates. Upon completion of the Work, clean all electrical equipment and the entire electrical installations in order to present a first class electrical installation suitable for occupancy. No loose part, scraps, tools and debris shall be left on the premises.

3.6 ELECTRICAL SERVICE FOR TESTING

- A. Construct sufficient temporary electric service and connect to refrigeration machines, related pumps, fans, fan coil units, elevators and other equipment furnished under other divisions of the specifications such that the equipment installers may begin testing 30 workdays before job completion deadline.

3.7 CUTTING AND PATCHING

- A. Be responsible for the cost of cutting and patching required in connection with work under this division of the specifications.
- B. Coordinate the work to eliminate unnecessary cutting of construction. Where it becomes necessary to cut through walls floors, ceilings and other construction to permit installation of the work, or to repair defective work under this division, the costs for such cutting and patching shall be included in this division of the work. Comply with other applicable divisions of the specifications concerning the quality of cutting and patching.
- C. Provide lintels or structural supports where openings are cut through masonry walls to protect the remaining masonry. Provide adequate support during the cutting operation to prevent any damage to the affected masonry.
- D. Cutting of structural members is not permitted unless specific written permission is granted by the Architect / Structural Engineer.

3.8 FLASHING, SLEEVES, INSERTS

- A. Maintain the integrity of the waterproofing of conduit penetrations through roofs, exterior walls and floors.
- B. Install counter-flashing on roof penetrations to provide a weatherproof installation.
- C. Install 22 gauge galvanized sheet iron sleeves for each conduit passing through floors. Extend sleeves 1-1/2 inches above the floor slab and cement watertight. The sizes of sleeves shall be installed to permit the subsequent of the proper size conduits or raceways.
- D. Install galvanized wrought iron pipe sleeves around conduits and raceways that pass through concrete beams or walls and masonry exterior walls. The inside diameter of these sleeves shall be at least 1/2-inch greater than the outside diameters of the service pipes. After the pipes are installed in these sleeves, fill the annular space between pipes and sleeves with mastic. The completed installation shall be watertight.
- E. Maintain the fire rating of penetrations through walls, floors and ceilings.
- F. Waterproofing and fireproofing work shall conform to the requirements of other applicable sections of the specifications.

3.9 FOUNDATIONS

- A. Install steel reinforced concrete foundations below all floor mounted switchboards, panelboards, motor control centers, transformers and other floor mounted electrical equipment.
- B. Concrete foundations shall not be less than 4 inches high. All top edges shall be neatly chamfered.
- C. Concrete foundations shall be 6 inches wider and 6 inches longer than the base of the equipment being installed.
- D. All concrete work shall be steel reinforced with a minimum of 6 inches by 6 inches No. 6 mesh and shall conform entirely to the requirements of the other sections of the specifications describing this class of work.

3.10 PAINTING

- A. Maintain original factory finish on all material and equipment installed under this division of the work unless specifically noted otherwise within the Contract Documents. Should the finish be marred in transit or during installation, it shall be finished to present a neat, workmanlike appearance. Leave equipment clean and free from any grease, dirt and rust and in a suitable condition for painting.

3.11 EXCAVATION AND BACKFILLING

- A. Excavate and backfill as necessary for the installation of the work under this division. Include shoring and pumping in ditches to keep them in dry conditions until the work has been installed. Perform all shoring required to protect the excavation and safeguard employees.
- B. Excavate to the proper depth, with allowances made for floor slabs, forms, beams, etc. Compact the ground under conduits before conduits are installed.
- C. Install exterior conduits with a minimum of 30 inches of cover below the finished grade, unless otherwise indicated.
- D. Use selected soil for backfilling, free from rocks and debris, pneumatically tamped with 6 inch layers to secure a field density ratio of 90 percent as defined by ASTM Designation D698-57T (Proctor Soil Compaction Test).
- E. Remove from the site excavated materials not suitable for backfill and not used in the backfill.
- F. Field check and verify the locations of all underground utilities. Avoid disturbing these as far as possible. In the event existing utilities are damaged, they shall be repaired to make their operation equal to before any trenching was started.
- G. Replace concrete, curbs, paving and other surface improvements cut during excavation to their original condition. In a lime stabilized area, the lime stabilization shall be fully restored after the excavation is complete.

3.12 IDENTIFICATION OF ELECTRICAL EQUIPMENT

- A. Identify electrical equipment in accordance with NEC, local authorities and in accordance with the requirements of the Contract Documents.
- B. Use laminated three-ply engraved plastic nameplates with black surface and white interior core, at least 1/16-inch thick. Engraved lettering shall be Helvetica at least --1/4-inch high and properly spaced for legible and easy reading. Attach plates to equipment with chromium plated screws. Adhesive attachment is not acceptable. Identify the following items with engraved nameplates, located as follows:
 - 1. Switchgear, distribution panels, panelboards and transformer nameplates shall include panelboard/transformer they are fed from, voltage, phase and wire configuration.
 - 2. Each circuit breaker in each main panel and each distribution panel - adjacent to circuit breaker.
 - 3. Spares and Spaces shall be labeled accordingly.
 - 4. Each branch circuit panel - on trim cover immediately above panel door.
 - 5. Each exhaust fan switch, relay cabinet, time clock-on outside of cover.
 - 6. Each exhaust fan switch - custom engraved on outside of switch coverplate (high and low if required).
 - 7. Each motor starter - on outside of cover.
 - 8. Outside light switches - custom engraved on outside of switch coverplate.
 - 9. Any switch for load that cannot be seen from the control point - custom engraved on outside of switch coverplate.
 - 10. Pushbuttons and control devices.

11. As noted on plans.

- C. Custom engraving on cover plates for items noted above shall be equal to custom engraving as performed by Hubbell, or accepted substitute.
- D. Branch circuit panelboard directories shall be completely and properly typewritten, including room numbers. Room numbers and names shall be as finally designated at the jobsite, coordinate with architect/owners representative.
- E. Identifying Tape for Buried Conduits: 6 inches wide, polyethylene, with printing continuous along length of tape, Brady Identoline.
 - 1. For buried electric power conduits - yellow with black letters.
 - 2. For buried electric communication conduits - green with black letters.
- F. Refer to other sections of the specifications for conductor color coding requirements.

3.13 BALANCING OF PANELS

- A. At the completion of the installation of the electrical system, check each phase of all panels under full load and arrange loads such that all phases carry the proper proportion of load.

3.14 LOCKING OF ELECTRICAL FACILITIES

- A. Provide padlocks for exterior electrical facilities subject to unauthorized entry.
- B. Furnish locks to match Owner's locking system. Key all locks alike.
- C. Furnish Owner with two keys per lock up to a quantity of ten keys.
- D. Install locks immediately upon installation of electrical facility.

3.15 ACCESS DOORS

- A. Whenever access is required in walls, ceilings, or soffits to concealed junction boxes, pull boxes or other electrical equipment installed under this division, provide and install access doors as indicated herein.
- B. Furnish and install hinged access door and frame with flush latch handle as follows:
 - 1. Plaster surfaces - Milcor Style K, or accepted substitute.
 - 2. Ceramic tile or drywall surface - Milor Style M (with 'B' label where required), or accepted substitute.
 - 3. Install panels in locations approved by the Architect / Owner and paint as directed.

3.16 RECORD DOCUMENTS

- A. Job set: Promptly following receipt of the Owner's Notice to Proceed, secure from the Architect at no charge to the Contractor, one complete set of all Documents comprising the Contract.
- B. Final Record Documents: At a time nearing the completion of the work, secure from the Architect at no charge to the contractor one complete set of sepia transparencies of all Drawings in the Contract.

- C. Maintenance of Job Set: Immediately upon receipt of the job set described in paragraph above, identify each of the Documents with the title, "RECORD DOCUMENTS - JOB SET".
- D. Preservation:
1. Considering the Contract completion time, the probable number of occasions upon which the job set must be taken out of the new entries and for examination, and the conditions under which these activities will be performed, devise a suitable method for protecting the job set to the approval of the Architect.
 2. Do not use the job set for any purpose except entry of new data and for review by the Architect, until start of transfer of data to final Project Record Documents.
 3. Maintain the job set at the site of Work as that site is designated by the Architect.
- E. Making Entries on Drawings:
1. Using erasable colored pencil (not ink or indelible pencil), clearly describe the change by graphic line and note as required.
 2. Date all entries.
 3. Call attention to the entry by a 'cloud' drawn around the area or areas affected.
 4. In the event of overlapping changes, use different colors for the overlapping changes.
 5. All equipment shall be clearly indicated in its installed location. Exposed items or those easily accessible, as above lay-in ceilings, may be located to scale. Concealed items not readily accessible, such as underground piping, shall be located by dimension.
- F. Transfer of Data to Final Project Documents;
1. Approval of recorded data prior to transfer:
 - a. Following receipt of the transparencies described above, and prior to beginning transfer of recorded data thereto, secure the Architect's approval of all recorded data.
 - b. Make required revisions.
 2. Transfer of Data to Drawings:
 - a. Carefully transfer change data shown on the job set of Record Drawings to the corresponding transparencies, coordinating the changes as required.
 - b. Clearly indicate at each affected detail and other drawing a full description of changes made during construction, and the actual location of items described above.
 - c. Call attention to each entry by drawing a 'cloud' around the area or areas affected.
 - d. Make changes neatly, consistently, and with the proper media to assure longevity and clear reproduction.
- G. Review and Submittals:
1. Submit the completed set of Project Record Documents to the Architect as described above.
 2. Participate in review meetings as required.
 3. Make required changes and promptly deliver the final Project Record Documents to the Architect.

3.17 OPERATIONS AND MAINTENANCE DATA

- A. Accumulate, as the job progresses, the following data, in duplicate, prepared in a 1 1/2"x11" stiff covered binder with clearly labeled filing tabs, and deliver to the Architect for checking and subsequent delivery to the Owner.
1. Manufactures' warranties, guarantees, service manuals, catalog brochure information and operating instructions on equipment and materials covered by this division of the specifications.
 2. Copies of approved Shop Drawings.
 3. Any and all other data and/or Drawings required during construction.
 4. Repair parts list of all major items and equipment including name, address, and telephone number of local supplier and agent.

3.18 INSTRUCTION OWNER'S PERSONNEL

- A. Provide the services of competent engineers or technicians acceptable to the Architect to instruct representatives of the Owner in the complete and detailed operation of each item of equipment, and each system. These instructions shall be provided for whatever periods may be necessary to accomplish the desired results. Upon completion of these instructions, the Contractor shall obtain a Letter of Release, acknowledged by the Owner or his Authorized Representative, stating the dates on which the various kinds of instruction were given, and the personnel to whom the instructions were given.
- B. Be responsible for proper maintenance of equipment and systems until the instructions have been given to the Owner's personnel and the letter of release acknowledged.
- C. In providing the instructions to the Owner's personnel, follow the written operating and maintenance manuals in all instances, and familiarize the Owner's personnel with such manuals. Operating and maintenance manuals used for instructions shall include wiring diagrams, manufacturers' operation and maintenance manuals, parts lists (with sources identified), and other data as appropriate for each system, and as required elsewhere in the Specifications to be furnished to the Owner prior to final acceptance of the project.

3.19 LOCAL PARTS AND SERVICE

- A. Each item equipment furnished on this project shall have local representation, factory-authorized service, and an adequate stock or repair parts. "Local" shall be defined, for this purpose, as "within 150 miles of the project site".

3.20 INSTALLATION INSPECTIONS AND CERTIFICATIONS

- A. Obtain timely inspections of the installation by the constituted authorities. Remedy any deficiencies to the satisfaction of the inspection authority.
- B. Upon final completion of the Work, obtain certificates of acceptance from the constituted authorities. Deliver the certificates to the Architect for transmission to the Owner.

3.21 OPERATION PRIOR TO ACCEPTANCE

- A. When any equipment is operable, and it is to the advantage of the Contractor to operate the equipment, he may do so provided that he properly supervises the operation and retains full responsibility for the equipment operated. Regardless of whether or not the equipment has or has not been operated, clean the equipment properly, make required adjustments, and complete punchlist before final acceptance by the Owner.

- B. The date of acceptance by the Architect, for beneficial use by the Owner, shall be the beginning date of the warranty period.

3.22 ACCEPTANCE OF THE WORK

- A. The Work, when completed, will be accepted in a finished, perfect and undamaged state only. Provide for protection of the Work during its progress, and if damaged, do all patching or replacing necessary to its full and satisfactory completion.

3.23 WARRANTY

- A. Furnish a written certificate, guaranteeing all materials, equipment and labor to be free of all defects for a period of one year from the date of final acceptance by the Owner of the Work, and guarantee that if any defects appear within the stipulated guarantee period, such work shall be replaced without charge.
- B. This guarantee shall be extended to include the capacity and integrated performance of all component parts of the various systems.
- C. Lamps for light fixtures shall be excluded from the guarantee requirements of this section.

3.24 TRAINING

- A. Provide (1) 8 hour block of training and familiarization of the equipment installed with the owner's selected representative.
- B. Reference other sections for detailed training requirements.

3.25 INTENT OF SPECIFICATIONS

- A. It is the intention that this Specification provide a complete installation. Include all accessory construction and apparatus necessary to the operation and testing of the work under this division. The omission of specific reference to any part of the work necessary for such complete installation shall not relieve this Contractor from furnishing and installing such parts.

END OF SECTION 260100

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SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1-GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Electrical equipment coordination and installation.
 - 2. Sleeves for raceways and cables.
 - 3. Sleeve seals.
 - 4. Grout.
 - 5. Common electrical installation requirements.

1.03 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.04 SUBMITTALS

- A. Product Data: For sleeve seals.

1.05 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
 - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping".

PART 2-PRODUCTS

2.01 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.02 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following product by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: EPDM OR NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 3. Pressure Plates: Carbon steel include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.03 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3-EXECUTION

3.01 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

3.02 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.03 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.04 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 260500

PART 1-GENERAL

1.1 SUMMARY OF WORK

A. This section includes the following:

1. Excavating and backfilling of trenches within building lines.
2. Excavating and backfilling for underground mechanical and electrical utilities and buried mechanical and electrical appurtenances.

1.2 REFERENCED STANDARDS

A. Standards referenced in the text of this Section are listed below according to source, designation, and title.

1. American Society for Testing and Materials (ASTM):
 - D1556-82 Test Method for Density of Soil In-Place by Sand-Cone Method.
 - D1557-78 Standard test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb. (4.54-Kg) Rammer and 18-in. (457-Mm) Drop.
 - D2167-84 Test Method for Density and Unit Weight of Soil In-Place by the Rubber Balloon Method.
 - D2487-85 Standard Test Method for Classification of Soils for Engineering Purposes.
 - D2922-81 Test Methods for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).
 - D3017-78 Test Methods for Moisture Content Of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).
 - D4254-83 Standard Test Methods for Minimum Index Density of Soils and Calculations of Relative Density.
 - E699-79 Practice for Criteria for Evaluation of Agencies (1984) Involved in Testing, Quality Assurance, and Evaluating Building Components in Accordance with Test Methods Promulgated by ASTM Committee E-6.
2. Society of Automotive Engineers:
 - SAE J 732-80 Specification Definitions - Loaders.

1.3 DEFINITIONS

- A. Excavation consist of removal of material encountered to subgrade elevations indicated in subsequent disposal of materials removed.
- B. Unauthorized excavation consist of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Architect/Engineer. Unauthorized excavation, as well as remedial work directed by Architect/Engineer, shall be at Contractor's expense.
- C. Subgrade: The undisturbed pavement, earth or the compacted soil layer immediately below pavement, granular subbase, drainage fill, or topsoil materials.
- D. Structure: Buildings, foundations, slabs, tanks, curbs or other man-made stationary features occurring above or below ground surface.

1.4 QUALITY ASSURANCE

- A. Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.

1.5 PROJECT CONDITIONS

- A. 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.
 - 1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damages utilities to satisfaction of utility owner.
 - 2. Do not interrupt existing utilities serving facilities occupied by Owner or others, during occupied hours, except when permitted in writing by Architect and then only after acceptable temporary utility services have been provided.
 - 3. Provide minimum of 48-hour notice to Architect, and receive written notice to proceed before interrupting any utility. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shutoff of services if lines are active.
- B. Use of Explosives: Use of explosives is not permitted.
- C. Protection of Persons and Property: Protection of Persons and Property will be the responsibility of the contractor. Barricade open excavations occurring as part of this work.
 - 1. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
 - 2. Perform excavation by hand within dripline of large trees to remain. Protect root systems from damage or dry out to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with moistened burlap.

PART 2-PRODUCTS

2.1 SOIL MATERIALS

- A. Satisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups GW, GP, GC, GM, SM, SC, SW, SP, and CL.
- B. Unsatisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups ML, MH, CH, OL, OH, and PT.
- C. Subbase Material: Naturally or artificially graded mixtures of natural or crushed gravel, crushed stone, crushed slag, and natural or crushed sand.
- D. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing a 1-1/2 inch sieve and not more than 5 percent passing a No.4 sieve.

- E. Backfill and Fill Materials: Satisfactory soil materials free of clay, rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.

PART 3-EXECUTION

3.1 EXCAVATION

- A. Excavation is unclassified and includes excavation to subgrade elevations indicated, regardless of character or materials and obstructions encountered.
- B. Excavation Classifications: The following classifications of excavation will be made when rock is encountered:
 - 1. Earth Excavation includes excavation of pavements and other obstructions visible of surface; underground structures, utilities, and other items indicated to be demolished and removed; together with earth and other materials encountered that are not classified as rock or unauthorized excavation.
 - 2. Rock excavation for trenches and pits includes removal and disposal of materials and obstructions encountered that cannot be excavated with a track-mounted power excavator, equivalent to Caterpillar Model No. 215C LC, and rated at not less than 115 HP flywheel power and 32,000-pound drawbar pull and equipped with a short stick and a 42-inch wide, short tip radius rock bucket rated at 0.81 cubic yard (heaped) capacity. Trenches in excess of 10 feet in width and pits in excess of 30 feet in either length or width are classified as open excavation.

3.2 STABILITY OF EXCAVATIONS

- A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction.
- B. Slope sides of excavation to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

3.3 DEWATERING

- A. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site surrounding area.
 - 1. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

3.4 STORAGE OF EXCAVATED MATERIALS

- A. Stockpile excavated materials acceptable for backfill and fill where directed. Place, grade, and shape stockpiles for proper drainage.

1. Locate and retain soil materials away from edge of excavations. Do not store within dripline of trees indicated to remain.
2. Dispose of excess excavated soil material and materials not acceptable for use as backfill or fill.

3.5 TRENCH EXCAVATION FOR PIPES AND CONDUITS

- A. Excavate trenches to uniform width, sufficiently wide to provide ample working room and minimum of 6 to 9 inches of clearance on both sides of pipe or conduit.
- B. Excavate trenches and conduit to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on undisturbed soil. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
 1. Where rock is encountered, carry excavation 6 inches below required elevation and backfill with a 6-inch layer of crushed stone or gravel prior to installation of pipe.
 2. For pipes or conduit less than 6 inches in nominal size, and or flat-bottomed, multiple-duct conduit units, do not excavate beyond indicated depths. Hand excavated bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.
 3. For pipes and equipment 6 inches or larger in nominal size, shape bottom of trench to fit bottom of pipe for 90 degrees (bottom 1/4 of the circumference). Fill depressions with tamped sand backfill. At each pipe joint, dig bell holes to relieve pipe bell of loads ensure continuous bearing of pipe barrel on bearing surface.

3.6 BACKFILL AND FILL

- A. General: Place soil materials in layers to require subgrade elevations, for each area classification listed below, using materials specified in Part 2 of this Section.
 1. Under grassed areas, use satisfactory excavated or borrow material.
 2. Under walks and pavements, use subbase material, satisfactory excavated or borrow material, or a combination.
 3. Under steps, use subbase material.
 4. Under building slabs, use drainage fill material.
 5. Under piping, conduit and equipment, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation. Shape excavation bottom to fit bottom 90 degrees of cylinder.
 6. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings and that are carried below bottom of such footings or that pass under wall footings. Place concrete to level of bottom of adjacent footing.
 - a. Concrete is specified in Division 32.
 - b. Do not backfill trenches until test and inspections have been made and backfilling is authorized by Authority Having Jurisdiction. Use care in backfilling to avoid damage or displacement of pipe systems.
- B. Backfill excavations as promptly as work permits, but not until completion of the following:
 1. Acceptance of construction below finish grade including, where applicable, damp-proofing, waterproofing, and perimeter insulation.
 2. Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded.

3. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structures or utilities, or leave in place if required.
4. Removal of trash and debris from excavation.
5. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

3.7 PLACEMENT AND COMPACTION

- A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill materials on surfaces that are muddy, frozen, or contain frost or ice.
- C. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.
- D. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by Authority Having Jurisdiction if soil density tests indicate inadequate compaction.
 1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density, in accordance with ASTM D 1557:
 - a. Under lawn or unpaved areas, compact top 6 inches of subgrade and each layer of backfill or fill material at (90) percent maximum density.
 2. Under walkways, compact top 6 inches of subgrade and each layer of backfill or fill material at 85 percent maximum density.
 3. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.
 - a. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
 - b. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

3.8 FIELD QUALITY CONTROL

- A. Quality Control Testing During Construction: Allow testing service to inspect and approve each subgrade and fill layer before further backfill or construction work is performed.
 1. Perform field density tests in accordance with ASTM D 1556 (sand cone method) or ASTM D2167 (rubber balloon method), as applicable.

- a. Field density tests may also be performed by the nuclear method in accordance with ASTM D 2922, providing that the calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. In conjunction with each density calibration check, check the calibration curves furnished with the moisture gages in accordance with ASTM D 3017.

3.9 EROSION CONTROL

- A. Provide erosion control methods in accordance with requirements of authorities having jurisdiction.

3.10 MAINTENANCE

- A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.
- C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.
- D. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.11 DISPOSAL OF EXCESS AND WASTE MATERIALS

- A. Removal from Owner's property: Remove excess excavated material, waste materials, including unacceptable excavated material, trash and debris, and dispose of it off Owner's property.
- B. Removal to Designated Areas on Owner's Property: Transport acceptable excess excavated material to designated soil storage areas by Owner's property. Stockpile soil or spread as directed by Architect.

END OF SECTION 260505

PART 1-GENERAL

1.1 SUBMITTALS

- A. Samples: Provide samples upon written request.
- B. Product Data: Manufacturer's specifications and installation instructions.

1.2 SUMMARY OF WORK

- A. Provide all labor, materials, supervision, tools, services, equipment and incidentals necessary for complete and operational systems as specified under this division, as shown on the Contract Drawings or as required.

PART 2-PRODUCTS

2.1 MATERIALS

- A. Acceptable Manufacturers:
 - 1. Caulk and Putty: 3M's No. CP-25 and No. CP-303 synthetic elastomers.
 - 2. Wrap/Strip: 3M's No. FS-195 organic/inorganic, fire resistive sheet with aluminum foil on one side.
 - 3. Composite Sheet: 3M's No. CS-195 organic/inorganic fire resistive elastomeric sheet, bonded on one side with 28-gauge galvanized steel and the other side with reinforced hexagonal shaped steel wire mesh and covered with aluminum foil.
 - 4. Thunderline Model "LS/Link-Seal" seals, of the required size and number of links, shall be used on all conduit penetrations of exterior walls. Similar fittings by O.Z./Gedney shall be considered approved equivalents.

PART 3-EXECUTION

3.1 INSTALLATION

- A. Review the detailed requirements of the UL through penetration firestop assembly to be used and verify dimensional requirements such as maximum conduit size, conduit spacing, maximum opening size, minimum length of sleeve, etc.
- B. For sealing of sleeves on or below grade and in wet locations, install line seals around all conduit penetrations properly sealing the annular space between the sleeve and the conduit to provide a waterproof seal.
- C. Attach an adhesive warning label identifying the firestop assembly and warning against removal without proper resealing.
- D. Provide sealing of penetrations in above and in dry/damp locations, both horizontal and vertical, utilizing intumescent (expand when heated) materials designed to be applied as a fire, cold smoke,

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noxious gas, and water sealant, and having a UL classified "through-penetration" firestop system meeting Nos. 33, 49, 61 through 66, and 90 through 105, inclusive.

END OF SECTION 260510

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.02 SUBMITTALS

- A. Product Data: For each type of product.

1.03 QUALITY ASSURANCE

- A. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.01 CONDUCTORS AND CABLES

- A. Aluminum and Copper Conductors, Insulation, and Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658.

2.02 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.03 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

PART 3 - EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders shall be copper or aluminum as indicated on plans.

- B. Branch circuits shall be copper.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-THWN, single conductors in raceway; Type XHHW, single conductors in raceway; Type SE or Type USE multiconductor cable.
- B. Exposed Feeders: Type THHN-THWN, single conductors in raceway; Type XHHW, single conductors in raceway; Metal-clad cable, Type MC.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway; Type XHHW, single conductors in raceway; Service-entrance cable, Type SE.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway; Type XHHW, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway; Metal-clad cable, Type MC.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway; Metal-clad cable, Type MC; Nonmetallic-sheathed cable, Type NM.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway; Type XHHW, single conductors in raceway.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

3.04 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.05 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

END OF SECTION 260519

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PART 1-GENERAL

1.1 WORK INCLUDED

- A. Furnish labor, materials and equipment necessary to install wire connections and devices.

1.2 REFERENCE SECTIONS

- A. Section 26 0100 - General Requirements for Electrical Work
- B. Section 26 0519 - Wires and Cable - 600-Volt

1.3 SUBMITTALS

- A. Submittals shall be in accordance with Section 26 0100 and Division 1. Submit copies of the manufacturer's specifications and catalog cut sheets for products to be used.

1.4 QUALITY ASSURANCE

- A. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2-PRODUCTS

2.1 CONNECTOR, COMPRESSION

- A. For splicing and termination; 600 volt wiring; connectors for cable sized #8 AWG and larger shall be the long barrel type for double indentation. Soldered connections shall not be permitted.

2.2 CONNECTOR, 600 VOLT TWIST-ON

- A. Spring insulated may be used for #14 through #10 gauge conductors.

2.3 CONNECTOR, 600 VOLT TERMINAL

- A. Connector shall have two holes in the tongue for use on conductor sizes 250 kcmil or larger; not required for connections to the branch circuit breaker in electrical panels.

2.4 INSULATION

- A. Insulate any connection made with non-insulated connectors. Provide sufficient amount of tape to equal wire insulation. Half lap each layer. Use UL listed electrical tape.

2.5 GROUNDING CONNECTION

- A. Provide exothermic connection to ground rod and underground connection to the grounding systems.
- B. The exothermic welding system furnished under these specifications shall meet the applicable requirements of IEEE-80, Chapter 9.
- C. Two styles of exothermic connection shall be available: One primarily for indoor and the other for outdoor application.
 - 1. Exothermic connection to be used outdoors shall be suitable for exposure to the elements or direct burial.
 - 2. Exothermic connection to be made in finished buildings or confined spaces shall use the double filtered, low smoke, low emission, process which is metallurgically equal to the above connection.
- D. Molds shall be made from material withstanding welding temperatures. The molds shall bear permanent marking, indicating the name of the manufacturer, the mold model, the type and size of welding mixture compatible with the welding process, and the size of the conductor. The installer is prohibited from using a mold from one manufacturer with a different manufacturer's welding mixture.

PART 3-EXECUTION

3.1 INSTALLATION

- A. Splice 600 Volt conductors in junction boxes or at outlets only. Splices, excluding those made with insulated wire nuts, shall be insulated with electrical tape or heat-shrink tubing to a level equal to the 600-volt rating of the factory insulated conductors. Electrical connections utilizing lugs with threaded set screws and wire sizes of 1/0 AWG and larger shall have an oxide inhibitor applied to prevent oxidation.
- B. Connection to electrically operated equipment is included in this contract, whether or not specifically mentioned.

END OF SECTION 260520

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes grounding and bonding systems and equipment.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.02 CONDUCTORS

- A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.

2.03 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.04 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m).

PART 3 - EXECUTION

3.01 EQUIPMENT GROUNDING

- A. Install per NFPA 70.

END OF SECTION 260526

SECTION 26 05 27 - TELECOMMUNICATIONS BONDING INFRASTRUCTURE

PART 1 GENERAL

1.01 REQUIREMENTS

- A. The Division 27 Contractor shall work with the Division 26 Contractor who shall be responsible for the bonding and grounding system and shall follow Section 26 05 26, "Grounding & Bonding" requirements and include the telecommunications bonding and grounding listed in Section 1.02.B.1, below. The Division 27 Contractor shall be responsible for bonding work identified in Section 1.02.B.2 below.
- B. The Contractor shall supply a bonding system as shown on the Drawings, specified herein and based upon ANSI/TIA-607-D Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.

1.02 SCOPE OF WORK

- A. The aim of this document is to install a proper bonding system to achieve the following needs:
 - 1. Safety from electrical hazards
 - 2. Reliable signal reference within the network
 - 3. Satisfactory and/or enhanced electromagnetic performance of the network
- B. The "Bonding and Grounding System" shall be a shared responsibility between the Division 26 (Electrical) Contractor and Division 27 (Low Voltage) Contractor. See schematic diagram on drawings. The Division 27 Contractor shall be responsible for coordinating his/her work with the Division 26 Contractor and the General Contractor.
 - 1. The Division 26 Contractor shall supply and install the bonding and grounding system as specified in Section 26 05 26, "Grounding and Bonding" and also include the following:
 - a. Provide the PBB (Primary Bonding Busbar) in the MTR (Main Technology Room/Demarc room).
 - b. The PBB shall be connected to an earth ground (ground loop surrounding the building, if available) and the building steel.
 - c. Provide as SBB (Secondary Bonding Busbar) in each TR located throughout the facility.
 - d. Each SBB shall be connected to building steel and the equipment ground terminal of the nearest AC electrical panelboard serving the telecommunications equipment in the TR.
 - e. Provide and connect the TBB (Telecommunications Bonding Backbone) from the PBB to all SBBs. Provide the Secondary Bonding Conductors (SBCs).
 - 2. The Division 27 Contractor shall:
 - a. Connect via compression connectors all equipment, ladder rack, basket rack, telecom racks, cabinets, conduits, sleeves, and other equipment, in each TR and/or MTR, with bonding conductors to the SBB and/or PBB located in each TR and/or MTR.
- C. The Division 27 Contractor shall work with and coordinate with the Division 26 Contractor to ensure that all aspects of the grounding system are complete and operational.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Coordination Drawings: Scaled and dimensioned plans shall be submitted that indicate the Contractor's understanding of the location of busbars, the bonding requirements, and all bonding locations and types.
- C. Field Quality Control Reports

PART 2 PRODUCTS

2.01 BUSBARS

- A. The PBB (Primary Bonding Busbar) shall be solid copper busbar, 1/4 inch thick x 4 inches high x 12 inches (minimum) length, as required to be supplied by the Division 26 Contractor.
- B. The SBB (Secondary Bonding Busbar) shall be solid copper busbar, 1/4 inch thick x 2 inches high x 10 inches (minimum) length, as required to be supplied by the Division 26 Contractor.
- C. The PBB and SBB shall be drilled with holes per NEMA standard for attaching compression fittings to be supplied by the Division 26 Contractor.
- D. Vertical Rack Bonding Busbars (RBBs) shall be provided for all equipment racks by the Division 27 Contractor. RBBs provide clean bond to any rack mounted equipment regardless of whether or not equipment has an integrated grounding terminal. RBBs shall be a minimum 45U with universal mounting hole pattern.

2.02 COPPER CABLES

- A. All wire used for telecommunications bonding purposes shall be stranded copper and identified with green insulation. Non-insulated wire shall use green tape wrap at each termination point. When conductors are insulated, they shall be listed for the application (e.g., plenum). The bonding conductors shall not decrease in size as the bonding path moves closer to the termination point of the grounding electrode system.
- B. If not shown on Drawings, Division 26 Contractor shall size bonding conductors to be used for connecting the SBBs to the PBB and the building steel.
- C. Telecommunications Bonding Backbone (TBB) Conductor
 1. The TBB is a conductor that equalizes potentials between TRs on multiple floors of a building with an ultimate connection to the PBB.
 2. The TBB shall be installed in conduit.
 3. The TBB shall be minimum conductor size #6 AWG, and sized at 2 kcmil per linear foot up to a maximum size of 750 kcmil. These sizes are based upon TBB length per ANSI/TIA-607 recommendations. The Division 26 Contractor shall bring to the attention of the A/E anywhere the TBB sizing appears insufficient per the Table below.

Sizing of the TBB	
TBB Length in Linear Feet	TBB Size (AWG)
Less than 13	6
14-20	4
21-26	3
27-33	2
34-41	1
42-52	1/0

Sizing of the TBB	
TBB Length in Linear Feet	TBB Size (AWG)
53-66	2/0
67-84	3/0
85-105	4/0
106-125	250 kcmil
126-150	300 kcmil
151-175	350 kcmil
176-250	500 kcmil
251-300	600 kcmil
Greater than 301	750 kcmil

- D. Backbone Bonding Conductor (BBC)
1. The BBC is a conductor that equalizes potentials between TRs on the same floor.
 2. The BBC shall be installed in conduit.
 3. Multi-story buildings with multiple risers (multiple TBBs) shall employ a BBC between vertical grounding backbones at the top floor of the building and minimally at every third floor in between to the lowest floor level. The BBC conductor shall be no smaller than the largest sized TBB.
- E. Telecommunications Bonding Conductor (TBC)
1. The TBC is a conductor that bonds the PBB to the AC grounding (earthing) electrode system.
 2. The TBC shall be installed in conduit.
 3. The TBC conductor shall be no smaller than the largest sized TBB.
- F. Telecommunications Equipment Bonding Conductor (TEBC)
1. The TEBC is a conductor that bonds the equipment racks to the SBB or PBB.
 2. Racks and cabinets shall have individual rack bonding conductors (RBC) bonding to the TEBC.
 3. In smaller TRs (3-5 racks), it is acceptable to have TEBCs that go directly from each individual rack to the SBB.
- G. Alternating Current Equipment Ground (ACEG)
1. The ACEG is a conductor that bonds the nearest AC electrical panelboard serving the telecommunications equipment in the TR to the SBB or PBB.
- H. Secondary Bonding Conductor (SBC)
1. The SBC connects the SBB to the TBB.
 2. The SBC shall be sized to be a minimum of the greater of #6 AWG or the largest conductor bonded to the associated SBB.
- I. Unit Bonding Conductor (UBC)
1. The UBC connects rack-mounted equipment to the RBB.

2.03 EXOTHERMIC WELD

- A. Exothermic welds shall be powdered copper oxide and aluminum to form a molded homogeneous copper joint connection between the copper conductor and the material being bonded to.

2.04 LUGS

- A. All lugs shall be two-hole and have a long barrel construction with sufficient length to allow for two discrete crimps.

2.05 HTAPs

- A. All HTAPs shall contain a crimp location for the main cable run and a minimum of one tap.
- B. All HTAPs shall be provided with a clear cover.

PART 3 EXECUTION

3.01 WORK TO BE DONE

- A. The Division 26 Contractor shall provide the PBB and the SBB in each room requiring bonding.
- B. The Division 26 Contractor shall provide all bonding cabling required connecting the PBB to earth and building steel and all cabling required connecting the SBBs to building steel and to the PBB.
- C. The Division 26 Contractor shall provide all BBC conductors where required.
- D. The Division 27 Contractor shall provide and connect all bonding cables required in the MTR and TR to properly bond all equipment to the PBB and SBB.

3.02 INSTALLATION

- A. Conductor Terminations and Connections
 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 2. Underground Connections: Exothermic welded connectors except at test wells and as otherwise indicated.
 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 4. Connections to Structural Steel: Exothermic welded connectors.
 5. Connections to PBB, SBB, and RBB: Compression two-hole lugs or exothermic welded connectors.
- B. All bonding connections shall be prepared by cleaning and applying appropriate antioxidant joint compound.

3.03 TESTING

- A. The telecommunications bonding and grounding system shall be tested with an earth ground resistance tester used in the two-point testing method. If the resistance value is less than 0.1 Ohm between the two test points, the bonding is acceptable.
- B. Tests to be conducted:
 1. The installer and tester must be certified to conduct the testing.
 2. Test between the PBB and the service equipment (power) ground.
 3. Test between the PBB and each SBB in the system.

4. Test between the SBB and:
 - a. Equipment racks
 - b. Cable tray
 - c. Ladder rack
 - d. Telecommunications conduits
 - e. Electronic equipment
5. Test results shall be recorded and submitted to Owner and A/E. Include these test results in the "Record and Information Manual."

3.04 LABELING

- A. The Division 27 Contractor shall provide labeling for all bonding conductors that originate in or are routed through the MTRs and TRs. Labels shall include the following or similar language, "If this connector or cable is loose or must be removed, please call the building telecommunications manager."

END OF SECTION

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.02 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.03 QUALITY ASSURANCE

- A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
1. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
- B. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 3. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 4. Toggle Bolts: All-steel springhead type.
 5. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.01 SUPPORT INSTALLATION

- A. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
1. To Wood: Fasten with lag screws or through bolts.
 2. To New Concrete: Bolt to concrete inserts.
 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 4. To Existing Concrete: Expansion anchor fasteners.
 5. To Light Steel: Sheet metal screws.
 6. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- B. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.02 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete.
- C. Anchor equipment to concrete base.
1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.03 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

PART 1-GENERAL

1.1 SUMMARY

- A. Refer to section for General Requirements for Electrical Work.
- B. Furnish all labor, materials, services, equipment and appliance required in conjunction with the installation of empty conduit systems for telephone, communication, data, fire alarm, HVAC controls, security, door access and other systems as indicated in the Contract Documents or as required by other trades.

1.2 SUBMITTALS

- A. Manufacturer's Data: Submit copies of manufacturer's specifications for products used.

1.3 REFERENCE

- A. This section refers to any empty conduit system installed on this project, including telephone systems.

1.4 QUALITY ASSURANCE

- A. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Provide 3/4-inch thick marine plywood boards painted with one coat of primer and two coats of latex enamel color to match surroundings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. At each telephone board, install #6 copper ground wire from nearest cold water pipe to telephone board and leave 12-inch pigtail at telephone board.
- B. Install pull wire in all empty conduits or conduit systems. Label pull wire indicating the locations of the other end.
- C. Limit number of bends and radius of each bend for telephone conduit system to comply with requirements of the telephone company.

- D. Install junction and pull boxes in empty conduits for telephone system in accordance with telephone company requirements.
- E. Coordinate the work under this section with the work under other divisions of the specifications.

END OF SECTION 260531

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SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

1.02 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.03 QUALITY ASSURANCE

- A. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.01 METAL CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. GRC: Comply with ANSI C80.1 and UL 6.
- C. ARC: Comply with ANSI C80.5 and UL 6A.
- D. IMC: Comply with ANSI C80.6 and UL 1242.
- E. EMT: Comply with ANSI C80.3 and UL 797.
- F. FMC: Comply with UL 1; zinc-coated steel.
- G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:
 - a. Material: Steel or die cast.
 - b. Type: Setscrew or compression.
3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

2.02 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ENT: Comply with NEMA TC 13 and UL 1653.
- C. PVC: Comply with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. LFNC: Comply with UL 1660.
- E. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- F. Fittings for LFNC: Comply with UL 514B.

2.03 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Description: Sheet metal, complying with UL 870 and NEMA 250, of appropriate NEMA Type, and sized according to NFPA 70.
 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.04 SURFACE RACEWAYS

- A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5.
- C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

2.05 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, Type FD, with gasketed cover.
- D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- E. Metal Floor Boxes:
 - 1. Material: Cast metal or sheet metal.
 - 2. Type: Fully adjustable or Semi-adjustable.
 - 3. Shape: Rectangular.
 - 4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- F. Nonmetallic Floor Boxes: Nonadjustable, round or rectangular.
 - 1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum or galvanized, cast iron, with gasketed cover.

2.06 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
 - 1. Standard: Comply with SCTE 77.
 - 2. Configuration: Designed for flush burial.
 - 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
 - 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - 5. Cover Legend: Molded lettering, "ELECTRIC".
 - 6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

PART 3 - EXECUTION

3.01 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed Conduit: GRC; IMC; PVC Schedule 80.
 - 2. Concealed Conduit, Aboveground: GRC; IMC; EMT; PVC.

3. Underground Conduit: PVC.
 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC; LFNC.
 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated.
1. Exposed, Not Subject to Physical Damage: EMT; ENT; PVC.
 2. Exposed, Not Subject to Severe Physical Damage: EMT; PVC identified for such use.
 3. Exposed and Subject to Severe Physical Damage: GRC.
 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 6. Damp or Wet Locations: GRC.
 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 in damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
 3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Install surface raceways only where indicated on Drawings.
- G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.02 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- D. Install no more than the equivalent of four 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- E. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- F. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- G. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.
 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 3. Arrange raceways to keep a minimum of 1 inch (25 mm) of concrete cover in all directions.
 4. Do not embed threadless fittings in concrete unless specifically approved by Engineer for each specific location.
- H. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- I. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- K. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35-mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- L. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- M. Surface Raceways:
1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- N. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.
- O. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 2. Where an underground service raceway enters a building or structure.
 3. Where otherwise required by NFPA 70.
- P. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m).
 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.

- b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C).
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
 - d. Attics: 135 deg F (75 deg C) temperature change.
 - 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degree F (0.06 mm per meter of length of straight run per degree C) of temperature change for PVC conduits.
 - 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 - 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- Q. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
- 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- R. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- S. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.
- T. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- U. Locate boxes so that cover or plate will not span different building finishes.
- V. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- W. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- X. Set metal floor boxes level and flush with finished floor surface.
- Y. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.03 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

- 1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified for pipe less than 6 inches (150 mm) in nominal diameter.
- 2. Install backfill as specified.
- 3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."

4. Install manufactured duct elbows for stub-up at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

3.04 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.
- D. Install handholes with bottom below frost line.
- E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.05 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies per specifications.

3.06 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies per specifications.

3.07 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

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PART 1 - GENERAL

1.1 SUMMARY

- A. Manufacturer's Data: Submit copies of manufacturer's specifications for products to be used.

1.2 SUMMARY OF WORK

- A. Provide all labor, materials, supervision, tools, services, equipment and incidentals necessary for complete and operational systems as specified under this division and as shown on the Contract Drawings.

1.3 QUALITY ASSURANCE

- A. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Pull boxes and junction boxes used on concealed runs of conduit in walls and over ceilings shall be of code gauge galvanized steel with sheet covers. Pull boxes in floors shall be of galvanized malleable cast iron, with gasketed covers. Exposed pull boxes or junction boxes installed outdoors shall be weatherproof and shall be provided with watertight gasketed covers fastened with corrosion resistant screws.
- B. Pull Boxes and Junction Boxes: Metal construction conforming to National Electrical Code, with screw-on or hinged cover.
- C. Flush-Mounted Pull Boxes: Provide overlapping covers with flush-head cover retaining screws, prime coated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Use separate pull boxes and junction boxes for electric power, control, computer and communication systems.
- B. Install pull boxes and junction boxes where required by the National Electrical Code and wherever required to overcome mechanical difficulties.
- C. Install pull boxes in interior conduit at not more than 100 feet apart when conduit runs are not broken by junction or outlets boxes.
- D. Size pull boxes and junction boxes to best meet the needs of the particular situation and/or location and to comply with the National Electrical Code.

- E. Coordinate the work in this section with the work under other divisions of this specification.

END OF SECTION 260535

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SECTION 26 05 43 - UNDERGROUND RACEWAYS

PART 1 GENERAL

1.01 DESCRIPTION

- A. Furnish and install all items necessary for a complete installation of underground and under slab raceway systems herein specified and as shown on the Drawings.

1.02 QUALITY ASSURANCE

- A. All equipment shall be UL listed and labeled and in accordance with applicable NEMA and ANSI Standards.
- B. Concrete work shall conform to the requirements of ACI 301-89.
- C. Refer to Section 03 30 00, "Cast-in-Place Concrete."
- D. Refer to Section 26 00 25, "Excavation, Backfill, and Protection of Utilities" for backfill requirements.

1.03 MANUFACTURERS

- A. Fabric Innerduct
 - 1. MaxCell
 - 2. Engineer approved equivalent

PART 2 PRODUCTS

2.01 RACEWAY AND FITTINGS

- A. PVC conduit shall be rigid non-metallic, Schedule 40 heavywall, UL approved for direct earth burial.
- B. Rigid galvanized steel conduit and associated fittings shall be the same as specified under Section 26 05 33, "Conduit and Fittings."
- C. Fiberglass conduit and associated fittings shall be the same as specified under Section 26 05 23, "Conduit and Fittings".
- D. PVC conduit fittings shall be slip joint type with cement furnished and recommended by the Manufacturer.
- E. Conduit elbows shall be rigid metal or fiberglass and be long radius type.

2.02 FABRIC INNERDUCT

- A. Unless noted otherwise on Drawings, for all site communications conduits connecting to the service provider or connecting buildings together, a minimum of (1) of the conduits in the ductbank shall have fabric innerduct provided.

- B. Standard Outdoor Woven Fabric Innerduct: Product ranging in size from 1" – 4" width for communications cable. Multi-cell (1,2,3 or 4) polyester/nylon fabric in a non-simple weave partial float zone configuration for minimum pulling tension. All cells along said innerduct will be joined along a continuous seam. Each cell containing minimum 1250lb polyester flat woven pull tape or 1250lb woven polyester/ polyethylene rope. Multiple packs may be pulled into a single empty conduit. (MXE series)
- C. Detectable Outdoor Woven Fabric Innerduct: Product ranging in size from 1" – 4" width for communications cable. Multi-cell (1,2,3 or 4) polyester/nylon fabric in a non-simple weave partial float zone configuration for minimum pulling tension. All cells along said innerduct will be joined along a continuous seam. Each cell containing 1250lb polyester flat woven pull tape or 1250lb woven polyester/ polyethylene rope. Each pack will contain a minimum 18AWG solid wire, with solid (non-stranded) polyvinyl/nylon conductor for tracing and rated for a minimum of 6 amps and 600 volts. Conductor shall be placed in the sidewall edge fold of the fabric sleeve. (MXD series)

2.03 CONCRETE ENVELOPES FOR RACEWAYS

- A. Concrete used for the encasement of raceways shall have a 28 day compressive strength of 3000 psi. Refer to Section 03 30 00, "Cast-in-Place Concrete" for information concerning concrete to be furnished under this Section.
- B. Colored Concrete
 - 1. Cement color shall be 95% pure mineral oxide (90% pure iron oxide) finely milled to pass a 325 mesh. Carbon added for darker shades shall be wettable and shall not exceed 3% of the weight of portland cement. Color pigments shall be light fast, wettable, weather resistant, alkali resistant, and free of deleterious fillers and extenders.
 - 2. Color shall be Solomon Grind #140 or equal.

PART 3 EXECUTION

3.01 APPLICATION

- A. Underground raceways shall be rigid galvanized steel conduit or Schedule 40 heavywall PVC.
- B. Use only rigid galvanized steel raceways for:
 - 1. Raceways underneath electric equipment pads
 - 2. Terminal pole risers
 - 3. All elbows both horizontal and vertical (45 degrees and greater)
 - 4. Metering conduit
 - 5. Additionally, where noted on the Drawings
 - 6. Fiberglass long sweep radius elbows are acceptable in lieu of RGS.
- C. Underground raceways shall be encased in a concrete envelope for the following installations:
 - 1. Primary voltage cable raceways exterior to the building
 - 2. Installed beneath footings
 - 3. Secondary voltage electric service entrance raceways between service transformer and service entrance equipment
 - 4. Voice/data ductbanks exterior to the building
 - 5. Raceways between emergency generators and service equipment
 - 6. Additionally, where noted on the Drawings

- D. Underground branch circuit raceways shall be a minimum of 1 inch.
- E. Branch circuit raceways (up to 1 1/2 inch size) may be run under slab-on-grade floors at bottom of gravel base. Only short runs of raceways connecting to floor boxes are permitted within the concrete of slab-on-grade floors.
- F. Raceways larger than 1 1/2 inch shall be run at 30 inches below finished grade or floor slab.

3.02 INSTALLATION

- A. All raceways shall have ends capped during construction to prevent entrance of mud or solids. Seal active raceways entering building from underground raceway system. Cap spare raceways. Mark ends of future raceways with a stake at ground surface. Provide pull cord in all spare raceways.
- B. Raceways shall be placed and sloped so that water will not enter into the building through them. Provide a pullbox in conduit runs to prevent water ingress where necessary.
- C. For conduits located under slab-on-grade concrete floors, conduits shall be routed in a single layer. Where necessary for conduits to be routed in a stacked arrangement, concrete envelope shall be provided to prevent voids in the ductbank. In areas of high conduit concentration, such as under electrical switchgear, complete concrete backfill of excavation shall be provided to avoid compromising support of concrete floor.
- D. Refer to Section 26 00 55, "Sleeves, Seals and Firestops" for raceways installed through below grade walls and floors.
- E. Spacers shall be used to provide a minimum 7 1/2 inch separation between adjacent centers of raceways in ductbanks as shown in the National Electrical Code for all conduits, both exterior, and within the limits of the building foundation, regardless of voltage. Ductbanks shall be limited to only two (2) conduits wide arrays unless at ends of runs where turning up into electrical equipment.
- F. Unless otherwise noted on the Drawings, underground raceways systems shall be installed 30 inches below finished grade to top of raceways. Coordinate with other site utilities and run deeper, if necessary. Always run below gas lines.
- G. Where trench depths are noted on the Drawings, depths shall be considered to mean buried depth to top of underground raceways.
- H. PVC raceways, where not encased in concrete, shall snake from side to side of trench for expansion relief.
- I. Underground raceway systems with manholes shall be installed with a minimum 3 inches per 100 foot slope to manhole for positive raceway drainage. Do not slope conduits toward building penetrations.
- J. Where noted, concrete encased underground raceways in trenches shall have a 3 inch minimum concrete envelope between any raceway and edge of envelope.
- K. Underground raceways installed below footings shall be concrete encased for full width and height of trench, extending 1 foot beyond each edge of footing.

- L. Raceway envelopes shall be installed by monolithic pour method and vibrated in place to insure flow into voids and complete encasement of raceways. Raceways shall be bundled with twine on plastic spacers not over 5 feet on center and providing minimum conduit separation of 7 1/2 inches of center. Use steel reinforcing rods for alignment side stakes and support bottom of raceways on plastic base spacers not over 5 feet on center. Keep bottom of trench clean of debris and water. Envelope may be poured with side forms or "neat" excavated trench walls. Reinforce envelopes with rebar and wire ties.
- M. Identification
 - 1. Location of underground raceways shall be identified with underground warning tape. Refer to Section 26 00 25, "Excavation, Backfill and Protection of Utilities" for warning tape requirements.
 - 2. Concrete encased primary and secondary service raceway envelope shall be placed using colored concrete. Mix color pigment with the concrete at a rate of approximately 4.5 lbs. per sack of cement. In no case shall the pigment weight exceed 10% of the weight of cement.
- N. Underground raceways run between equipment locations within the building shall be run within the confines of the building foundation walls.
- O. Raceways installed for parallel feeder conductors shall be installed so that each run is the same length as the others.
- P. Raceways shall not be run in same trenches with underfloor plumbing. Where crossing, conduits shall be run before piping.
- Q. Fabric Innerduct
 - 1. Installation site support is required during product installation at the initial phase of the project. Contact factory direct representation or local representative agency to coordinate. As an alternative with prior approval installer may supply certificate of completion for online training and best practices from the manufacturer.
 - 2. Provide fabric innerduct in conduit and wire ways using continuous unsliced lengths of fabric innerduct between maintenance holes, pull boxes, and/or termination points as indicated on the drawings.
 - 3. Make a 2" incision, approximately 18" from the end of fabric innerduct. Pull out and cut off approximately 2 feet of pull-tape, allowing the pull tape ends to retract back into the cells.
 - 4. Using roughly 3-4 feet of pull tape, tie a non-slip knot to the incision. Then tie 3 to 6 half-hitch knots down to the end of fabric innerduct. Apply black vinyl tape over all knots and the end of fabric innerduct. Using a bowline or fishing knot tie a swivel to the end of the pull tape. For multi-pack installations one swivel is sufficient, but stagger each fabric innerduct.
 - 5. Using a bowline or fishing knot, attach the pull rope located in the rigid conduit to the other end of the swivel. Install fabric innerduct – ensuring that no twist is introduced to the innerduct.
 - 6. Provide suitable fabric innerduct slack in the maintenance holes, hand holes, pull boxes, and at turns to ensure there is no kinking or binding of the product. Do not fasten fabric innerduct to steam, water, or other piping, ductwork, mechanical equipment, electrical equipment, electrical raceways, or wires.

END OF SECTION

SECTION 26 05 44 - LOW VOLTAGE OUTLET BOXES

PART 1 GENERAL

1.01 DESCRIPTION

- A. Low Voltage Outlet boxes shall be provided for IT devices, AV devices, security devices, special technology outlets, and as otherwise required.
- B. Low Voltage Outlet boxes shall be of sufficient size to provide free space for all conductors/cables enclosed in the box and to not exceed the minimum bend radius for any cable. Boxes shall be not less than the minimum size required by NEC Article 314 for the number and size of conductors contained within.

1.02 QUALITY ASSURANCE

- A. All equipment shall be UL listed and labeled and in accordance with applicable NEMA and ANSI Standards.

1.03 SUBMITTALS

- A. For Review:
 - 1. Product data sheets
 - 2. Layout drawings for television and monitor outlet box locations
- B. To be included in Record and Information Manuals:
 - 1. One (1) copy each of approved submittal

PART 2 PRODUCTS

2.01 LOW VOLTAGE OUTLET BOXES

- A. Flush device boxes in masonry walls to be masonry boxes designed for the purpose with raised covers designed for masonry.
- B. Where outlet boxes are to be cast in concrete slabs, they shall be boxes designed for concrete installation.
- C. Flush boxes for data / voice cabling shall be 4 11/16 inches square by 2 1/8 inches deep with one (1) gang plaster ring installed. Outlet boxes shall accommodate 1 inch conduit as required.
- D. Unless otherwise noted, all other television and monitor locations shall use a recessed TV box for both power and low-voltage. Basis of design is Legrand TV2MW with equivalents by Leviton, Hubbell, Carlon, and Arlington.
- E. Flush boxes for audio / video cabling (other than television and monitor locations) shall be 4 11/16 inches square by 3 1/4 inches deep with one (1) gang plaster ring cover installed. Coverplates shall be blank stainless steel. Outlet boxes shall have knockouts for 1 1/4 inch conduits, and knockouts for up to 2 inch conduits as required.

- F. Flush boxes for security cabling 4 11/16 inches square by 2 1/8 inches deep with one (1) gang plaster ring cover installed. Coverplates shall be blank stainless steel. Outlet boxes shall accommodate 3/4 inch conduits as required.
- G. Flush boxes for nurse call cabling shall be sized per manufacturer recommendation for each device type. Outlet boxes shall accommodate minimum 3/4 inch conduits as required.

PART 3 EXECUTION

3.01 INSTALLATION

- A. All boxes shall be rigidly supported from building structure independent of the conduit system. Boxes cast into masonry or concrete are considered to be rigidly supported. Framing members of suspended ceiling systems shall not be permitted as a support.
- B. Flush boxes shall finish within 1/4 inch of surface of non-combustible materials. Boxes shall not project beyond finished surfaces.
- C. Locations of all outlets are approximate. Final location shall be verified with the Architect in the field prior to installation.
- D. Install knockout closures for unused openings.
- E. Outlet boxes installed on opposite sides of a fire rated wall shall have a minimum of 24 inch spacing between adjacent boxes.
- F. All outlet boxes shall use stud to stud box brackets with far side supports.
- G. "Through-wall" type boxes shall not be used.
- H. Boxes shall not be installed in a "back-to-back" manner. Boxes shall be spaced at least 10 inches apart where in opposite walls within the same stud cavity unless a sound absorptive barrier is placed between boxes.

END OF SECTION

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.02 ACTION SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.03 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.01 POWER RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
1. Black letters on an orange field.
 2. Legend: Indicate voltage and system or service type.
- C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

- D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- F. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.02 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Colors for Raceways Carrying Circuits at 600 V and Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

2.03 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.
- D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.04 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- D. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.05 FLOOR MARKING TAPE

- A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.06 UNDERGROUND-LINE WARNING TAPE

- A. Tape:
 - 1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 - 2. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - 3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
- B. Color and Printing:
 - 1. Comply with ANSI Z535.1 through ANSI Z535.5.
 - 2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE.
 - 3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

2.07 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Baked-Enamel Warning Signs:
 - 1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
 - 2. 1/4-inch (6.4-mm) grommets in corners for mounting.

3. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 10 by 14 inches (250 by 360 mm).

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.08 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
 1. Engraved legend with black letters on white face.
 2. Punched or drilled for mechanical fasteners.
 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
- B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).
- C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.09 EQUIPMENT IDENTIFICATION LABELS

- A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.
- B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).
- C. Stenciled Legend: In nonfading, waterproof, [black] <Insert color> ink or paint. Minimum letter height shall be [1 inch (25 mm)].

2.10 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Apply identification devices to surfaces that require finish after completing finish work.
- C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches (400 mm) overall.
- G. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.02 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30A, and 120V to ground: Install labels at 30-foot (10-m) maximum intervals.
- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. Emergency Power.
 - 2. Power.
 - 3. UPS.
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.

3) Phase C: Blue.

- c. Colors for 480/277-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
- 1. Limit use of underground-line warning tape to direct-buried cables.
 - 2. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
- 1. Comply with 29 CFR 1910.145.
 - 2. Identify system voltage with black letters on an orange background.
 - 3. Apply to exterior of door, cover, or other access.
 - 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
- J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer or load shedding.

- L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 - 1. Labeling Instructions:
 - a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION 260553

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SECTION 26-0573

OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes short circuit and protective device coordination study encompassing the entire electrical distribution system from utility and on-site generated power sources up to and including breakers/fuses in service entrance switchboard, distribution breakers in switchboard, distribution breakers in sub-distribution panels, fuses in sub-distribution panels, main breakers in each panelboard (as applicable) and automatic transfer switches. In addition to the coordination study, electrical contractor shall provide arc flash hazard labeling in accordance with National Electrical Code 110.16, and shall provide specific hazard level information and PPE required at each location. Follow the guidelines as set forth in NFPA 70E *Standard for Electrical Safety in the Workplace*.
- B. Independent analysis for selective coordination of emergency system overcurrent devices is required. Emergency system overcurrent devices shall be selectively coordinated with all supply-side overcurrent protective devices, refer to NFPA 70, Part VI of Article 700 (if applicable).
- C. Related Sections:
 - 1. Section 26-0519: Low-Voltage Electrical Power Conductors and Cables.
 - 2. Section 26-2413: Switchboards.
 - 3. Section 26-2416: Panelboards.
 - 4. Section 26-2813: Fuses.
 - 5. Section 26-2819: Enclosed Switches.
 - 6. Section 26-2823: Enclosed Circuit Breakers.
 - 7. Section 26-2826: Enclosed Transfer Switches.
 - 8. Section 26-3213: Engine Generators.

1.2 REFERENCES

- A. Institute of Electrical and Electronics Engineers:
 - 1. IEEE 242 - Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems (Buff Book).
- B. National Fire Protection Association:
 - 1. NFPA 70 - National Electrical Code.

1.3 DESIGN REQUIREMENTS

- A. Complete Short Circuit and Protective Device Coordination Study to meet requirements of NFPA 70.
- B. Report Preparation:
 - 1. Prepare study prior to ordering distribution equipment to verify equipment ratings required.
 - 2. Perform study with aid of computer software program.
 - 3. Obtain actual settings for and motor characteristics for mechanical and plumbing equipment incorporated into Work.
 - 4. Include selective coordination requirements as indicated in NFPA 70, Article 700, Part VI.
 - 5. Calculate short circuit interrupting and, when applicable, momentary duties for assumed 3-phase bolted fault short circuit current and phase to ground fault short circuit current at each of the following:
 - a. Automatic transfer switch.
 - b. Engine generator.
 - c. Switchboards.
 - d. Distribution panelboards.
 - e. Branch circuit panelboards.
 - f. Each other significant equipment location throughout system.
- C. Report Contents:
 - 1. Include the following:
 - a. Calculation methods and assumptions.
 - b. Base per unit value selected.
 - c. One-line diagram.
 - d. Source impedance data including power company system available power and characteristics.
 - e. Typical calculations.
 - 1) Fault impedance.
 - 2) X to R ratios.
 - 3) Asymmetry factors.
 - 4) Motor fault contribution.
 - 5) Short circuit kVA.
 - 6) Symmetrical and asymmetrical phase-to-phase and phase-to-ground fault currents.
 - 7) Tabulations of calculation quantities and results.
 - f. One-line diagram revised by adding actual instantaneous short circuits available (AutoCad 2010 or later format and .pdf format)
 - g. State conclusions and recommendations.
 - 2. Prepare time-current device coordination curves graphically indicating coordination proposed for system, centered on conventional, full-size, log-log forms.
 - 3. Prepare with each time-curve sheet complete title and one-line diagram with legend identifying specific portion of system covered by that particular curve sheet.

4. Prepare detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings.
5. Plot device characteristic curves at point reflecting maximum symmetrical fault current to which device is exposed. Include on curve sheets the following:
 - a. Low voltage equipment circuit breaker trip device characteristics.
 - b. Low voltage equipment fuse characteristics.
 - c. Cable damage point characteristics.
 - d. Pertinent transformer characteristics including:
 - 1) Transformer full load current.
 - 2) Transformer magnetizing inrush.
 - 3) ANSI transformer withstand parameters.
 - 4) Significant symmetrical fault current.
 - e. Pertinent motor characteristics.
 - f. Generator characteristics including:
 - 1) Phase and ground coordination of generator protective devices.
 - 2) Decrement curve and damage curve.
 - 3) Operating characteristic of protective devices.
 - 4) Actual impedance value.
 - 5) Time constants.
 - 6) Current boost data.
 - 7) Do not use typical values for generator.
 - g. Transfer switch characteristics.
 - h. Other system load protective device characteristics.

1.4 SUBMITTALS

- A. Section 01-3300: Submittal Procedures: Requirements for submittals.
- B. Qualifications Data: Submit the following for review prior to starting study.
 1. Submit qualifications and background of firm.
 2. Submit qualifications of individual or individuals performing study.
- C. Software: Submit for review information on software proposed to be used in performing study.
- D. Sample of Arc Flash Data Labeling and Arc Flash Hazard Warning Labeling
- E. Product Data: Submit the following:
 1. Report: Summarize results of study in report format including the following:
 - a. Descriptions, purpose, basis, and scope of study.
 - b. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short-circuit duties, and commentary regarding same.

- c. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
- d. Fault current calculations including definition of terms and guide for interpretation of computer printout.

F. Submit copies of final report. Make additions or changes required by review comments.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with State and local codes and standards.
- B. Maintain one copy of each document on site.
- C. Use commercially available software, designed specifically for short circuit and protective device coordination studies with minimum of 5 years documented availability and as approved by Architect/Engineer.
- D. Perform study in accordance with IEEE 242.

1.6 QUALIFICATIONS

- A. Study Preparer: Company specializing in performing work of this section with minimum 5 years documented experience and having completed projects of similar size and complexity within the past 2 years.
- B. Demonstrate company performing study has capability and experience to provide assistance during system start up.

1.7 PRE-INSTALLATION MEETINGS

- A. Section 01-3000: Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.8 SEQUENCING

- A. Section 01-1000: Summary: Requirements for sequencing.
- B. Submit short circuit and protective device coordination study to Architect/Engineer 2 weeks prior to receiving final approval of distribution equipment shop drawings and prior to releasing equipment for manufacturing.

1.9 SCHEDULING

- A. Section 01-3000: Administrative Requirements: Requirements for scheduling.

- B. Schedule work to expedite collection of data to ensure completion of study for final approval of distribution equipment shop drawings prior to release of equipment for manufacturing.

1.10 COORDINATION

- A. Section 01-3000: Administrative Requirements: Requirements for coordination.
- B. Coordinate work with local power company.

PART 2 - PRODUCTS Not used.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

- A. Section 01-4000: Quality Requirements and 01-7700: Closeout Procedures: Field inspecting, testing, adjusting, and balancing.
- B. Provide assistance to electrical distribution system equipment manufacturer during start up of electrical system and equipment.

3.2 ADJUSTING

- A. Section 01-7700: Closeout Procedures: Requirements for starting and adjusting.
- B. Perform field adjustments of protective devices and modifications to equipment to place equipment in final operating condition. Adjust settings in accordance with approved short circuit and protective device coordination study.

END OF SECTION 260573

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SECTION 26 05 82 - UNDERGROUND JUNCTION BOXES

PART 1 GENERAL

1.01 DESCRIPTION

- A. Furnish and install underground junction boxes where required and/or as shown on the Drawings and specified herein. Boxes shall be provided where required to avoid an excessive number of bends and to facilitate wire pulling. Maximum distance between pull boxes shall not exceed 500 feet. Provide all accessories and equipment as necessary for a complete system.

1.02 QUALITY ASSURANCE

- A. All equipment shall be UL listed and labeled and in accordance with applicable NEMA and ANSI Standards.

1.03 SUBMITTALS

- A. For Review:
 - 1. Product data sheets of all components
- B. To be included in Record and Information Manuals:
 - 1. One (1) copy of each approved submittal

1.04 MANUFACTURERS

- A. Underground pull boxes
 - 1. Quazite Composolite
 - 2. Norwalk
 - 3. Synertech Products Inc.

PART 2 PRODUCTS

2.01 UNDERGROUND JUNCTION BOXES

- A. Underground junction boxes shall be constructed of gray polymer concrete and reinforced by heavy-weave fiberglass. Pull box rating shall be 8,000 lbs. over a 10" x 10" area designed for vehicular traffic.
- B. Junction boxes shall be 17" x 30" x 16" deep with tapered flanged footing, open bottom, stackable construction, with two (2) 4-inch mouse holes. Covers shall be flush mounted, with skid resistant surface, pentahead bolts, and "Electric" or "Communications" logo as appropriate.
- C. Junction boxes shall be Quazite PT 1730 BB.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install junction boxes where required and/or shown on the Drawings. Box covers shall be flush with surrounding soil.
- B. Install junction boxes on a gravel base that extends down to bottom of conduit excavation.

END OF SECTION

SECTION 26 07 10 - VOICE/DATA SYSTEMS RACEWAY

PART 1 GENERAL

1.01 DESCRIPTION

- A. Division 26 Contractor shall furnish and install outlet boxes, conduits, raceways, risers, service lateral conduits and backboards for voice/data systems raceways.
- B. Conduit stub-ups shall be provided in rooms with lay-in acoustic tile ceilings. In all other rooms, provide continuous conduit runs to nearest lay-in ceiling in corridors or directly to telecom rooms.

PART 2 PRODUCTS

2.01 OUTLET BOXES AND PLATES

- A. Refer to Section 26 05 35, "Low Voltage Outlet Boxes".

2.02 CONDUITS

- A. Conduits from voice/data outlet boxes shall be minimum 1 inch.
- B. Conduits and conduit sleeves run between voice/data terminal closets shall be 4 inches.
- C. Conduits run underground as service lateral raceway shall be 4 inches.
- D. Refer to Section 26 05 43, "Underground Raceways" and Section 26 05 33, "Conduit and Fittings."

2.03 PULL BOXES

- A. Pull boxes shall be of the following minimum dimensions for conduit sizes as shown:
 - 1. 1 inch conduit – 6" W x 12" L x 3" D
 - 2. 1 1/4 inch conduit – 12" W x 12" L x 4" D
 - 3. 3 inch conduit – 24" W x 24" L x 5" D
 - 4. 4 inch conduit – 12" W x 48" L x 6" D
- B. Pull boxes shall be galvanized or baked enamel steel with screw covers.

2.04 VOICE/DATA WALL FIELD BOARDS

- A. Service lateral conduits and riser conduits and sleeves shall terminate onto plywood voice/data wall field boards. Boards shall be of 4 feet by 8 feet by 3/4 inch fire retardant plywood mounted vertically in room with bottom at 8 inches AFF. Plywood shall be AC grade or better and void-free with Grade A surface exposed.

2.05 WALL SLEEVES

- A. Provide sleeve through walls from corridor into rooms where wall goes up to deck above.

- B. EZ-Path "Smoke and Acoustic Reclosable Cable Pathway"

2.06 ROOF SLEEVE

- A. Provide appropriate weather tight roof penetration sleeve for Emergency Responder Radio Repeater System cabling to roof mounted antennas.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide a minimum of two 4 inch conduits as service lateral raceways underground from communication service provider point to main telecom room in building.
- B. Provide a minimum of two 4 inch conduits or conduit sleeves between voice/data telecom rooms.
- C. Provide a minimum of two 4 inch conduits from each voice/data telecom room to above ceiling of main corridor or to cable tray system.
- D. Provide conduit stub-ups from each outlet location to above accessible ceiling space. Provide continuous conduits across exposed areas or areas of inaccessible ceilings. Provide conduits between isolated areas of accessible ceilings to provide a continuous pathway for wiring from main equipment location to each device. Floor outlets in slab on grade shall have conduits run up nearest column or wall to above accessible ceiling. Poke through type outlets shall have conduits run to above ceiling of main corridor on the floor below.
- E. All conduit elbows shall have the following minimum bend radius:
- | | |
|-------------------------|-----------|
| 1. 1 inch conduit - | 9 inches |
| 2. 1 1/4 inch conduit - | 12 inches |
| 3. 1 1/2 inch conduit - | 15 inches |
| 4. 2 inch conduit - | 18 inches |
| 5. 3 inch conduit - | 36 inches |
| 6. 4 inch conduit - | 48 inches |
- F. Conduits for outlets shown exterior to the building shall be continuous from the outlet box back to the telecommunications room for the use of exterior rated cable.
- G. All conduits shall have a pull cord installed.
- H. Restore all fire ratings of walls, floors, and ceilings penetrated by conduits.
- I. Provide a pull box in each conduit run that exceeds 100 feet in length. All pull boxes shall have straight through conduit entrance and exit. Pull boxes shall be installed in accessible locations.
- J. Conduit runs shall have a maximum of two 90 degree bends.
- K. Provide a blank coverplate on all outlet boxes without completed devices.

- L. Telecom rooms have been located such that all outlets shall have a maximum of 90 meters of cable length. Install outlet conduits in the shortest manner possible to avoid exceeding this cable length.

END OF SECTION

SECTION 26 07 12 - SECURITY SYSTEM RACEWAYS

PART 1 GENERAL

1.01 DESCRIPTION

- A. Division 26 Contractor shall furnish and install outlet boxes, conduits, and raceways for security systems.
- B. Conduit stub-ups shall be provided in rooms with lay-in acoustic tile ceilings. In all other rooms, provide continuous conduit runs to nearest lay-in ceiling in corridors or directly to telecom rooms.

PART 2 PRODUCTS

2.01 OUTLET BOXES AND PLATES

- A. Refer to Section 26 05 35, "Low Voltage Outlet Boxes".

2.02 CONDUITS

- A. Conduits from outlet boxes shall be minimum 3/4 inch.
- B. Refer to Section 26 05 33, "Conduit and Fittings."

2.03 PULL BOXES

- A. Pull boxes shall be of the following minimum dimensions for conduit sizes as shown:
 - 1. 3/4 inch conduit - 4" W x 12" L x 3" D
 - 2. 1 inch conduit - 6" W x 12" L x 3" D
 - 3. 1 1/4 inch conduit - 12" W x 12" L x 4" D
- B. Pull boxes shall be of baked enamel steel with screw covers.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Division 26 Contractor shall provide conduit stub-ups from each outlet location to above accessible ceiling space. Provide continuous conduits across exposed areas or areas of inaccessible ceilings. Provide conduits to between isolated areas of accessible ceilings to provide a continuous pathway for wiring from main equipment location to each outlet. Floor outlets in slab on grade shall have conduits run up nearest column or wall to above accessible ceiling. Poke-through type outlets shall have conduits run to above ceiling of main corridor on the floor below.
- B. All conduit elbows shall have the following minimum bend radius:
 - 1. 3/4 inch conduit - 5 inches
 - 2. 1 inch conduit - 9 inches
 - 3. 1 1/4 inch conduit - 12 inches

- 4. 1 1/2 inch conduit - 15 inches
- 5. 2 inch conduit - 18 inches
- C. All conduits shall have a pull cord installed.
- D. Restore all fire ratings of walls, floors, and ceilings penetrated by conduits.
- E. Provide a pull box in each conduit run that exceeds 100 feet in length. All pull boxes shall have straight through conduit entrance and exit. Pull boxes shall be installed in accessible locations.
- F. Conduit runs shall have a maximum of two 90 degree bends.

END OF SECTION

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Time switches.
2. Photoelectric switches.
3. Lighting contactors.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.03 QUALITY ASSURANCE

- A. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.01 TIME SWITCHES

A. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Astronomic Time.
3. Automatic daylight savings time changeover.
4. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.

B. Electromechanical-Dial Time Switches: Comply with UL 917.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Circuitry: Allows connection of a photoelectric relay as a substitute for the on-off function of a program.
3. Astronomic time dial.
4. Eight-Day Program: Uniquely programmable for each weekday and holidays.
5. Skip-a-day mode.
6. Wound-spring reserve carryover mechanism to keep time during power failures, minimum of 16 hours.

2.02 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Description: Solid state, with dry contacts rated for 1800 VA, to operate connected load, complying with UL 773.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lux), with an adjustment for turn-on and turn-off levels within that range.
 - 3. Time Delay: Thirty-second minimum, to prevent false operation.
 - 4. Lightning Arrester: Air-gap type.
 - 5. Mounting: Twist lock complying with NEMA C136.10, with base.

2.03 LIGHTING CONTACTORS

- A. Description: Electrically operated and mechanically held, combination-type lighting contactors, complying with NEMA ICS 2 and UL 508.
 - 1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
 - 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
 - 3. Enclosure: Comply with NEMA 250.
 - 4. Provide with control and pilot devices matching the NEMA type specified for the enclosure.

2.04 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG.
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors.
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.
- B. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
 - 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.

3.02 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Lighting control devices will be considered defective if they do not pass tests and inspections.

END OF SECTION 260923

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SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes distribution panelboards, lighting and appliance branch-circuit panelboards, and dwelling unit load centers.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Include evidence of NRTL listing for series rating of installed devices.
 - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 7. Include wiring diagrams for power, signal, and control wiring.
 - 8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

1.03 INFORMATIONAL SUBMITTALS

- A. Panelboard schedules for installation in panelboards.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.05 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NEMA PB 1.
- C. Comply with NFPA 70.
- D. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

1.06 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Flush- and surface-mounted cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 3R.
 - c. Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 - 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 - 4. Directory Card: Inside panelboard door, mounted in transparent card holder.
- B. Incoming Mains Location: Top and bottom.
- C. Phase, Neutral, and Ground Buses: Tin-plated aluminum or Hard-drawn copper, 98 percent conductivity.
- D. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Tin-plated aluminum or Hard-drawn copper, 98 percent conductivity.
 - 2. Main and Neutral Lugs: Compression or Mechanical type.
 - 3. Ground Lugs and Bus Configured Terminators: Compression or Mechanical type.
 - 4. Feed-Through Lugs: Compression or Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 - 5. Subfeed (Double) Lugs: Compression or Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.
- F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- G. Panelboard Short-Circuit Current Rating: Either of:
 - 1. Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, and listed and labeled for series-connected short-circuit rating by an NRTL.
 - 2. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.02 PERFORMANCE REQUIREMENTS

- A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 2.

2.03 DISTRIBUTION PANELBOARDS

- A. Panelboards: NEMA PB 1, power and feeder distribution type.
- B. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
- C. Mains: As indicated on drawings.
- D. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in or Bolt-on circuit breakers.
- E. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.04 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- B. Mains: As indicated on drawings.
- C. Branch Overcurrent Protective Devices: Plug-in or Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
- E. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.05 LOAD CENTERS

- A. UL Listed.
- B. Mains: Lugs only unless indicated otherwise.
- C. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

2.06 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with series-connected rating or interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.
 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
 7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
 8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Compression or Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - e. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on position.
 - f. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.
- B. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Section 262813 "Fuses."

2.07 ACCESSORY COMPONENTS AND FEATURES

- A. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Receive, inspect, handle, store and install panelboards and accessories according to NEMA PB 1.1.
- B. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.
- C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- D. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.
- E. Install filler plates in unused spaces.
- F. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- G. Comply with NECA 1.

3.02 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.03 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Test continuity of each circuit.
- C. Panelboards will be considered defective if they do not pass tests and inspections.

END OF SECTION 262416

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SECTION 26 26 30 - TWO-WAY EMERGENCY COMMUNICATIONS SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION

- A. Division 26 Contractor shall furnish and install two-way intercom communications system stations as shown on the Drawings and as specified herein. Provide all accessories and equipment as necessary for a complete and fully compliant system. Depending on the manufacturer provided, this may include line voltage power, low voltage power, phone lines, and supplies.
- B. The call station shall call pre-programmed phone numbers assigned to that call station. The base station shall be the primary number called by the call station with automatic roll-over to the off-site monitoring center (or 24/7 staffed location as determined by Owner) as the secondary number called with two-way off-site person to person voice communications.
- C. Drawings and Specifications are considered to be supplementing each other. Items drawn but not specified or specified but not drawn shall be performed or furnished as though mentioned in both the Specifications and the Drawings.
- D. System shall conform to the requirements of the ADAAG (Americans with Disabilities Act Accessibilities Guidelines), NFPA 72 (National Fire Alarm and Signaling Code), NPFA 101 (Life Safety Code), Ohio Building Code, and Local Code and Building Authority requirements.
- E. Systems shall be located in elevator landings and in area of refuge (rescue assistance) areas.

1.02 QUALITY ASSURANCE

- A. All equipment shall be UL listed and labeled and in accordance with applicable NEMA and ANSI Standards.

1.03 SUBMITTALS

- A. For Review:
 - 1. Product data sheets of all components
 - 2. Wiring Diagrams
 - 3. Layout Drawings locating all components of system
- B. To be included in Record and Information Manuals:
 - 1. One (1) copy of each approved submittal
 - 2. Test results
 - 3. Certificate of System Completion

1.04 MANUFACTURERS

- A. The manufacturer basis for design shall be Rath Security. Equivalents by:
 - 1. Talk-A-Phone
 - 2. Jeron Electronics
 - 3. Cornell

PART 2 PRODUCTS

2.01 CALL STATION

- A. The flush mounted call station shall be an ADA compliant hands-free telephone access emergency phone. The emergency phone shall have a single call button to dial pre-programmed emergency numbers.
- B. The emergency phone shall have the following features:
 - 1. The faceplate shall be stainless steel.
 - 2. The faceplate shall be 9.5" H x 7.5" W.
 - 3. The backbox shall be 8" H x 6" W x 3" D.
 - 4. Communication shall be hands-free two-way.
 - 5. Power shall be via the phone line. (No external power supply will be needed.)
 - 6. Non-volatile programming can be done from any telephone.
 - 7. Minimum of two programmed calling numbers with automatic roll-over to secondary number if the primary number is unanswered. If the location of the base station is not constantly attended, it shall have a timed automatic communications capability to connect with a constantly attended monitoring location acceptable to the AHJ where responsible personnel can initiate the appropriate response.
 - 8. The call station shall include the capability to record a message identifying the location of the call.
- C. The call station shall be a Rath 2100 Series or Engineer-approved equivalent, with a matching backbox.
- D. The call stations must be in full compliance with Americans with Disabilities ACT (ADA). Call stations require a hands-free speakerphone with an LED to indicate status of call.
- E. The call stations must allow the programming of a specific location message of the call station. This allows rescue personnel to know the location of the activated call station.
- F. The call stations are to be located no higher than 48 inches above ground level to the center of the push button to ensure conformance with the ADA requirements.
- G. The call stations must have a Braille faceplate located no higher than 48 inches for front reach and 54 inches for side reach above ground level to ensure conformance with the ADA requirements.

2.02 BASE STATION

- A. The base station shall indicate an incoming call with a strobe/sounder and call location LED, allowing rescue personnel to know with call station needs assistance. The base station allows rescue personnel to speak to all call stations or individual call stations.
- B. The base station shall have the following features:
 - 1. Provides power to the call stations
 - 2. LED on base station indicates call station location
 - 3. Built-in four (4) hour battery backup in case of power failure
 - 4. Built-in phone
 - 5. Line seizure for off-site calling lines eliminating the need for a dedicated phone line
- C. The base station shall be a Rath 2500 Series or Engineer-approved equivalent.

- D. The 24 volt DC power supply must be capable of supplying power to the base station and all call stations. The power supply shall be a Rath 2500-PWR24U or Engineer-approved equivalent.

2.03 CABLING

- A. Cabling shall meet the applicable requirements for pathway survivability. Cabling shall consist of one or more of the following:
 - 1. 2-hour fire-rated circuit integrity (CI) cable
 - 2. 2-hour fire-rated cable system
 - 3. 2-hour fire-rated enclosure or protected area
- B. Cabling shall be shielded twisted 20 gauge pair terminating at a telephone junction block. The system shall be connected to a standard telephone (voice) line for off-site calling.

2.04 SIGNAGE

- A. The self-adhesive wall signage at each call station shall have raised lettering and Braille for ADA-compliance. Signage shall be Rath 7087 or Engineer-approved equivalent, stating "Emergency Communication". For areas designated as an area of refuge, the sign shall be Rath 7044 or Engineer-approved equivalent, stating "Area of Refuge". For areas requiring two-way emergency communications that are not designated as an area of refuge, the sign may instead state "Two-Way Emergency Communications".
- B. The self-adhesive wall instructional signage at each call station shall have raised lettering and Braille for ADA-compliance. Signage shall be Rath 7049 Series or Engineer-approved equivalent.
- C. The illuminated sign shall be 14.0" by 10.5" and shall be wall or ceiling mounted as shown, 120 volt. The sign shall have an integral battery to provide 90 minutes of emergency run time. For areas designated as an area of refuge, the sign shall "Area of Refuge" and shall be Rath 7050 / 7050D or Engineer-approved equivalent. For areas requiring two-way emergency communications that are not designated as an area of refuge, illuminated signs are not required. Illuminated signs shall match exit signs in building.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Division 26 Contractor shall install call stations and base station as shown on the Drawings in accordance with Manufacturer's written instructions.
- B. Coordinate exact wiring requirements with Equipment Manufacturer.
- C. The illuminated Area of Refuge sign shall be circuited to the nearest exit sign circuit.

3.02 MONITORING

- A. Coordinate with Owner to arrange for an off-site monitoring agency associated with this communication system or a 24/7 staffed location selected by Owner.

3.03 TESTING

- A. Division 26 Contractor shall provide a complete functional test of all components in accordance with Manufacturer's recommendations.
- B. Operate system for a minimum of seven (7) consecutive days with no problems before final acceptance by Owner.
- C. Refer to Section 26 08 40, "Electrical Tests, Adjustments, Inspection."

3.04 EQUIPMENT DEMONSTRATION

- A. After all system tests have been completed, schedule an instruction period with the Owner. Instruction to be provided by Manufacturer's authorized field technician.
- B. Instruction shall include:
 - 1. Location of all components of the system and explanation of their function
 - 2. Demonstration of equipment
 - 3. Maintenance and repair procedures
 - 4. Review of documents in Record and Information Manuals

3.05 WARRANTY

- A. System shall be warranted for a period of three years.

END OF SECTION

SECTION 262713 - ELECTRICITY METERING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes equipment for electricity metering by utility company.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Dimensioned plans and sections or elevation layouts and wiring diagrams.

1.03 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.01 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

- A. Meters will be furnished by utility company.
- B. Current-Transformer Cabinets: Comply with requirements of electrical-power utility company.
- C. Meter Sockets: Comply with requirements of electrical-power utility company.
- D. Meter Sockets: Steady-state and short-circuit current ratings shall meet indicated circuit ratings.
- E. Modular Meter Center: Factory-coordinated assembly of a main service disconnect device, wireways, tenant meter socket modules, and tenant feeder circuit breakers arranged in adjacent vertical sections. Assembly shall be complete with interconnecting buses and other features as specified below.
 - 1. Comply with requirements of utility company for meter center.
 - 2. Housing: NEMA 250, Type 1 (indoor) or Type 3R (outdoor) enclosure.
 - 3. Minimum Short-Circuit Rating: Contractor shall obtain fault current information from utility company, perform short circuit calculations, and size equipment accordingly.
 - 4. Main Disconnect Device: Circuit breaker, series-combination rated for use with downstream feeder and branch circuit breakers.
 - 5. Main Disconnect Device: Fusible switch, series-combination rated by circuit-breaker manufacturer to protect downstream feeder and branch circuit breakers.
 - 6. Tenant Feeder Circuit Breakers: Series-combination-rated molded-case units, rated to protect circuit breakers in downstream tenant and to house loadcenters and panelboards that have 10,000-A interrupting capacity.
 - a. Identification: Complying with requirements in Section 260553 "Identification for Electrical Systems" with legend identifying tenant's address.

b. Physical Protection: Tamper resistant, with hasp for padlock.

7. Meter Socket: Rating coordinated with indicated tenant feeder circuit rating.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with equipment installation requirements in NECA 1.
- B. Install meters furnished by utility company. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.
- C. Install modular meter center according to NECA 400 switchboard installation requirements.
- D. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
 - 1. Series Combination Warning Label: Self-adhesive type, with text as required by NFPA 70.
 - 2. Equipment Identification Labels: Adhesive film labels with clear protective overlay. For residential meters, provide an additional card holder suitable for printed, weather-resistant card with unit designation.

END OF SECTION 262713

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Weather-resistant receptacles.
3. Snap switches and wall-box dimmers.
4. Solid-state fan speed controls.
5. Wall-switch and exterior occupancy sensors.
6. Communications outlets.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.04 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.05 QUALITY ASSURANCE

A. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.02 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Wiring devices installed in dwelling units may be residential grade. All other wiring devices shall be "spec" or commercial grade.
- D. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
 - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
 - 2. Devices shall comply with the requirements in this Section.

2.03 STRAIGHT-BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R (dwelling units), NEMA WD 6 Configuration 5-20R (others), and UL 498.

2.04 GFCI RECEPTACLES

- A. General Description:
 - 1. Straight blade, feed or non-feed-through type.
 - 2. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943 Class A.
 - 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20A, 15A (dwelling units):

2.05 TOGGLE SWITCHES

- A. Comply with NEMA WD 1, UL 20, and FS W-S-896.
- B. Switches, 120 V (120/277V if required), 20 A, 15 A (dwelling units):
- C. Pilot-Light Switches, 20 A:
 - 1. Description: Single pole, with neon-lighted handle, illuminated when switch is "off."
- D. Key-Operated Switches, 120/277 V, 20 A:
 - 1. Description: Single pole, with factory-supplied key in lieu of switch handle.

2.06 DECORATOR-STYLE DEVICES

- A. Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.

- B. GFCI, Feed or Non-Feed-Through Type, Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, UL 498, and UL 943 Class A.
- C. Toggle Switches, Square Face, 120 V (120/277V if necessary), 15 A: Comply with NEMA WD 1, and UL 20.
- D. Lighted Toggle Switches, Square Face, 120 V, 15 A: Comply with NEMA WD 1 and UL 20.
 - 1. Description: With neon-lighted handle, illuminated when switch is "off."

2.07 RESIDENTIAL DEVICES

- A. Fan Speed Controls:
 - 1. Modular, 120-V, full-wave, solid-state units with integral, quiet on-off switches and audible frequency and EMI/RFI filters.
 - 2. Comply with UL 1917.
 - 3. Continuously adjustable slider, 1.5 A.
 - 4. Three-speed adjustable slider, 1.5 A.
- B. Telephone Outlet:
 - 1. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1. Comply with UL 1863.
- C. Combination TV and Telephone Outlet:
 - 1. Description: Single RJ-45 jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1. Comply with UL 1863.

2.08 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.
- C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.
 - 1. 600 W; dimmers shall require no derating when ganged with other devices.
- D. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.09 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: Smooth, high-impact thermoplastic.

3. Material for Unfinished Spaces: Smooth, high-impact thermoplastic.
 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.10 FINISHES

- A. Device Color:
1. Wiring Devices Connected to Normal Power System: White unless otherwise required by NFPA 70 or device listing.
 2. Wiring Devices Connected to Emergency Power System: Red.
- B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtail existing conductors is permitted, provided the outlet box is large enough.
- D. Device Installation:
1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.

3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of service poles to suit arrangement of partitions and furnishings.

3.02 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.03 FIELD QUALITY CONTROL

A. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
3. Using the test plug, verify that the device and its outlet box are securely mounted.

- B. Wiring device will be considered defective if it does not pass tests and inspections.

END OF SECTION 262726

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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. Cartridge fuses rated 600 V and less for use in switches, controllers and motor-control centers.
 - 2. Spare-fuse cabinets.

1.03 SUBMITTALS

- A. Product Data: Include the following for each fuse type indicated:
 - 1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
 - 2. Let-through current curves for fuses with current-limiting characteristics.
 - 3. Time-current curves, coordination charts and tables, and related data.
 - 4. Fuse size for elevator feeders and elevator disconnect switches.
- B. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
 - 1. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
 - 2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
- C. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - a. Let-through current curves for fuses with current-limiting characteristics.
 - b. Time-current curves, coordination charts and tables, and related data.
 - c. Ambient temperature adjustment information.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- C. Comply with NEMA FU 1.
- D. Comply with NFPA 70.
- E. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

1.05 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.06 COORDINATION

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.

1.07 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: Quantity equal to 5 percent of each fuse type and size, but no fewer than 3 of each type and size.

PART 2-PRODUCTS

2.01 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

2.02 SPARE-FUSE CABINET

- A. Cabinet: Wall-mounted, 0.05-inch- (1.27-mm-) thick steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
 - 1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
 - 2. Finish: Gray, baked enamel.
 - 3. Identification: "SPARE FUSES" in 1-1/2-inch- (38-mm-) high letters on exterior of door.
 - 4. Fuse Pullers: For each size of fuse.

PART 3-EXECUTION

3.01 EXAMINATION

- A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

- B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 FUSE APPLICATIONS

- A. Feeders: Class L, time delay.
- B. Motor Branch Circuits: Class RK1 and RK5, time delay.
- C. Other Branch Circuits: Class RK1, time delay, RK5, time delay, J, fast acting, J, time delay.

3.03 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install spare-fuse cabinet(s).

3.04 IDENTIFICATION

- A. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION 262813

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SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Receptacle switches.
4. Shunt trip switches.
5. Molded-case circuit breakers (MCCBs).
6. Enclosures.

1.02 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
1. Wiring Diagrams: For power, signal, and control wiring.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.05 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.01 FUSIBLE SWITCHES

- A. Type GD, General Duty, Single Throw, 240-V ac, 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with cartridge fuse interiors to accommodate indicated fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- B. Type HD, Heavy Duty, Single Throw, 240 V ac or 600 V ac as indicated, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Type HD, Heavy Duty, Six Pole, Single Throw, 240 V ac or 600 V ac as indicated, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. Type HD, Heavy Duty, Double Throw, 240 V ac or 600 V ac as indicated, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- E. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 - 4. Lugs: Suitable for number, size, and conductor material.
 - 5. Service-Rated Switches: Labeled for use as service equipment.

2.02 NONFUSIBLE SWITCHES

- A. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- B. Type HD, Heavy Duty, Single Throw, 240 V ac or 600 V ac as indicated, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Type HD, Heavy Duty, Six Pole, Single Throw, 240 V ac or 600 V ac as indicated, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. Type HD, Heavy Duty, Double Throw, 240 V ac or 600 V ac as indicated, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- E. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Lugs: Suitable for number, size, and conductor material.

2.03 RECEPTACLE SWITCHES

- A. Type HD, Heavy-Duty, Single-Throw Fusible Switch: 240 V ac or 600 V ac as indicated, 30, 60, or 100 A as indicated; UL 98 and NEMA KS 1; horsepower rated, with clips or bolt pads to accommodate indicated fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- B. Type HD, Heavy-Duty, Single-Throw Nonfusible Switch: 240 V ac or 600 V ac as indicated, 30, 60, or 100 A as indicated; UL 98 and NEMA KS 1; horsepower rated, lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- C. Interlocking Linkage: Provided between the receptacle and switch mechanism to prevent inserting or removing plug while switch is in the on position, inserting any plug other than specified, and turning switch on if an incorrect plug is inserted or correct plug has not been fully inserted into the receptacle.
- D. Receptacle: Polarized, three-phase, four-wire receptacle (fourth wire connected to enclosure ground lug).

2.04 SHUNT TRIP SWITCHES

- A. General Requirements: Comply with ASME A17.1 (if elevators are present), UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.
- B. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- C. Control Circuit: 120-V ac with a control power source of enough capacity to operate shunt trip, connected pilot, and indicating and control devices.
- D. Accessories:
 1. Oiltight key switch for key-to-test function.
 2. Oiltight ON pilot light.
 3. Isolated neutral lug.
 4. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
 5. Form C alarm contacts that change state when switch is tripped.
 6. Three-pole, double-throw, fire-safety and alarm relay; 120-V ac or 24-V dc coil voltage.
 7. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.

2.05 MOLDED-CASE CIRCUIT BREAKERS

- A. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- B. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

- C. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
 - 1. Instantaneous trip.
 - 2. Long- and short-time pickup levels.
 - 3. Long- and short-time time adjustments.
 - 4. Ground-fault pickup level, time delay, and I^2t response.
- D. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- E. Features and Accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles.
 - 2. Lugs: Suitable for number, size, trip ratings, and conductor material.
 - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
 - 4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
 - 5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.

2.06 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Outdoor Locations: NEMA 250, Type 3R.
 - 3. Wet or Damp, Indoor Locations: NEMA 250, Type 4.
 - 4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Install fuses in fusible devices.
- D. Comply with NECA 1.

3.02 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.03 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 1. Test continuity of each circuit.
- C. Tests and Inspections:
 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

END OF SECTION 262816

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PART 1-GENERAL

1.1 SCOPE

- A. These specifications describe the electrical and mechanical requirements for a hybrid electrical Surge Protection Device/filter system integrating both surge protection devices (SPD's) and electrical high frequency noise filtering for exposure locations as defined in the latest edition of ANSI/IEEE C62.41.

1.2 REFERENCE STANDARDS

- A. ANSI/IEEE C.62.41 and C62.45
- B. UL 1449 – 3rd Edition 2009 Revision (effective 9/29/2009)
- C. UL 1283
- D. NEC – NFPA 70
- E. NEMA LS1 and LS2
- F. NFPA
- G. OSHA
- H. IEEE Std. 1100

1.3 QUALITY ASSURANCE

- A. The unit shall be designed and assembled in the USA by a qualified manufacturer of TVSS products and line conditioning equipment. The manufacturer shall have been engaged in the design and manufacture of such products for a minimum of 10 years.
- B. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

1.4 SUBMITTALS

- A. Submittals shall be in accordance with Division 1 and shall include:
 - 1. Manufacturer's catalog information showing dimensions, configurations, and specifications.
 - 2. Copies of independent test reports UL 1449 and NEMA LS1 and LS2.
- B. Provide actual UL 1449, Third edition Type 1 20kA nominal discharge current documentation showing the Voltage Protection Ratings (VPR) as well all engineering considerations for the specific catalog number submitted. Typical UL 1449 data is not acceptable.

- C. Provide third party test documentation demonstrating that the device is capable of surviving the specified maximum surge current rating without failure or component degradation greater than 10%. Test documentation shall clearly show that tests were performed on a complete device including all necessary fusing and disconnects.
- D. Provide data confirming that the device is capable of surviving the published number of repetitive ANSI/IEEE 62.41, Category C3, 20kV/10KA impulses without failure or performance degradation.
- E. Provide test documentation demonstrating that the device is capable of surviving the specified short circuit fault current rating.
- F. Provide a complete test documentation package per the recommendations of NEMA LS1 and LS2.
- G. Line by Line compliance matrix demonstrating adherence to these specifications.

PART 2-PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Current Technology

2.2 SERVICE ENTRANCE SWITCHBOARD (1200 AMPERES and LARGER) Protective DEVICE

A. General

- 1. Unit Operating Voltage. The nominal unit operating voltage and configuration shall be as indicated on the drawings.
- 2. Maximum Continuous Operating Voltage (MCOV). The MCOV shall be greater than 115% of nominal voltage for all products.
- 3. Operating frequency range shall be 47-63 Hertz.
- 4. Surge Rating shall be 200kA per mode
- 5. Monitoring System shall include as a minimum, this monitoring shall include one set of status monitoring lights that will provide visual indication of voltage present to the SPD for each phase of protection. The lights shall also indicate when suppressor protection has degraded to any value of less than 50%. Status indicator lights that simply indicate the presence of voltage, and provide no indication of performance, will be unacceptable. Additionally, the unit shall include an audible alarm with battery backup, a current-sensing surge counter, and two sets of Form C contacts for remote monitoring. Additionally, the unit shall include a visual status of suppression protection available, shown in a percentage from 0% to 100%; indication of the number of swells (voltage > 110% of nominal); surges (voltage > 130% of peak voltage); sags (voltage < 90% of nominal); and outages (power interruptions > 1 cycle) the device has encountered.
- 6. Acceptable Products shall be, no substitutions:
 - a. Liebert # SI040 Series
 - b. Current Technology # TG200 Series.

B. Physical

- 1. Enclosure: The specified system shall be provided in a heavy duty NEMA 4 dust-tight, drip-tight enclosure with no ventilation openings.
- 2. Provide a plastic lexan cover with lock for outdoor applications.

C. Electrical

1. Unit shall be UL1449, 3rd Edition (September 29, 2009) Type 1 20kA nominal discharge current Listed. A SPD that is a UL "Recognized" component will not be accepted.
2. Each surge suppression and filter element shall be individually fused so that a failure of one element and/or fuse shall not affect nor operate any other fuse element. SPD shall have a short-circuit rating of 200kAIC. Devices that accomplish this rating by requiring or providing additional fusing to the SPD system will not be accepted.
3. All fusing elements shall be UL Listed or Recognized as a complete fusing system.
4. Unit shall include solid-state, long-life externally mounted LED visual status indicators that indicate the on-line status and operational integrity of the unit.
5. Unit shall have a Form C summary alarm output contact rated for at least 1 amp at 120VAC for remote annunciation of SPD status.

D. Performance

1. Rated Single Pulse Surge Current Capacity. The rated single pulse surge current capacity, in amps, for each mode of protection of the unit shall be no less than 200,000 Amps per mode, based on ANSI/IEEE C62.41 Standard 8X20 μ sec current waveform.
2. Tested Single Pulse Surge Current Capacity. Suppression filter systems shall be single pulse surge current tested in all modes at rated surge currents by an industry-recognized independent test laboratory. The test shall include a UL1449 Third Edition surge defined as a 1.2X50 μ sec, 6000V open circuit voltage waveform and an 8X20 μ sec, 3000A short circuit current waveform to benchmark the unit's suppression voltage, followed by a single pulse surge of maximum rated surge current magnitude with an 8X20 μ sec waveform. To complete the test, another UL1449 surge shall be applied to verify the unit's survival. Survival is achieved if the suppression voltage measured from the two UL1449 surges does not vary by more than 10%.
3. Minimum Life Cycle Rating. Per ANSI/IEEE C62.41 and ANSI/IEEE C62.45, Test suppression filter systems in every mode utilizing a 1.2X50 μ sec, 20 KV open circuit voltage, 8X20 μ sec, 10 KA short circuit current Category C3 bi-wave at one minute intervals without suffering performance degradation of more than 10% deviation of clamping voltage. Tested life under these conditions shall be no less than 5,000 impulses per mode.
4. UL1449 Voltage Protection Rating. All suppression filter system clamping voltages shall be in compliance and listed by UL1449 3rd edition Type 1 with a nominal discharge current of 20kA. Maximum listed clamping voltages shall be as follows:
 - a. Unit shall provide maximum UL1449 3rd Edition Voltage Protection Rating (VPR) for 208Y/120 Volt systems as follows:
 - L-N = 700V
 - L-G = 700V
 - N-G = 700V
 - L-L = 1000V
 - b. Unit shall provide maximum UL1449 3rd Edition Voltage Protection Rating (VPR) for 480Y/277 Volt systems as follows:
 - L-N = 1000V
 - L-G = 1200V
 - N-G = 1000V
 - L-L = 1800V
5. Noise Attenuation - The unit shall be UL1283 in Type 2 locations Listed as an electromagnetic interference filter. The filter shall provide 41dB at 100kHz, 31dB at 1MHz, 35dB at 10MHz, 53dB at 100MHz, per 50 Ohm Insertion Loss Methodology from MIL 220A. The system shall provide up to 120-dB insertion loss from 100 kHz to 100 MHz when used in a coordinated facility system.
6. Overcurrent Protection - Each suppression element shall be individually fused such that the failure of a single component or the operation of a single fuse element remains isolated and does not render the entire mode, or product, deficient by more than 5%. Fusing shall be present in all modes, including Neutral-to-Ground. The device shall be

capable of withstanding the full single pulse surge current capacity for every mode without the operation or failure of overcurrent / fault current protection or fuses.

7. Internal Conductor Path. All full magnitude transient current shall be conducted utilizing low-impedance copper bus bar. No plug-in component modules or quick-disconnect terminals shall be used in surge current-carrying paths.

2.3 DISTRIBUTION PANEL (400 AMPERES TO 1200 AMPERES) Protective DEVICE

A. General

1. Unit Operating Voltage. The nominal unit operating voltage and configuration shall be as indicated on the drawings.
2. Maximum Continuous Operating Voltage (MCOV). The MCOV shall be greater than 115% of nominal voltage for all products.
3. Operating frequency range shall be 47-63 Hertz.
4. Surge Rating shall be 80kA per mode
5. Monitoring shall include: As a minimum, this monitoring shall include one set of status monitoring lights that will provide visual indication of voltage present to the SPD for each phase of protection. The lights shall also indicate when suppressor protection has degraded to any value of less than 50%. Status indicator lights that simply indicate the presence of voltage, and provide no indication of performance, will be unacceptable. Additionally, the unit shall include an audible alarm with battery backup, and a set of Form C contacts for remote monitoring.
6. Acceptable Products shall be, no substitutions:
 - a. Liebert #All Series.
 - b. Current Technology #TG80 Series.

B. Physical

1. Enclosure: The specified system shall be provided in a heavy duty NEMA 4 dust-tight enclosure with no ventilation openings.
2. Provide a plastic lexan cover with lock for outdoor applications.

C. Electrical

1. Unit shall be UL1449, 3rd edition (September 29, 2009) Type 1 with a nominal discharge current of 20kA Listed. A SPD that is a UL "Recognized" component will not be accepted.
2. Each surge suppression and filter element (MOV) shall be individually fused so that a failure of one element and/or fuse shall not affect nor operate any other fuse element. SPD shall have a short-circuit rating of 200kAIC. Devices that accomplish this rating by requiring or providing additional fusing to the SPD system will not be accepted.
3. All fusing elements shall be UL Listed or Recognized as a complete fusing system.
4. Unit shall include solid-state, long-life externally mounted LED visual status indicators that indicate the on-line status and operational integrity of the unit.
5. Unit shall have a Form C summary alarm output contact rated for at least 1 amp at 120VAC for remote annunciation of SPD status.

D. Performance

1. Rated Single Pulse Surge Current Capacity. The rated single pulse surge current capacity, in amps, for each mode of protection of the unit shall be no less than 80,000 Amps per mode.
2. Tested Single Pulse Surge Current Capacity. Suppression filter systems shall be single pulse surge current tested in all modes at rated surge currents by an industry-recognized independent test laboratory. The test shall include a UL1449 Third Edition surge defined as a 1.2X50 μ sec, 6000V open circuit voltage waveform and an 8X20 μ sec, 3000A short circuit current waveform to benchmark the unit's suppression voltage, followed by a single pulse surge of maximum rated surge current magnitude with an 8X20 μ sec waveform. To complete the test, another UL1449 surge shall be applied to verify the unit's survival. Survival is achieved if the suppression voltage measured from the two UL1449 surges does not vary by more than 10%.

3. Minimum Life Cycle Rating. Per ANSI/IEEE C62.41 and ANSI/IEEE C62.45-1992, Test suppression filter systems in every mode utilizing a 1.2X50 μ sec, 20 KV open circuit voltage, 8X20 μ sec, 10 KA short circuit current Category C3 bi-wave at one minute intervals without suffering performance degradation of more than 10% deviation of clamping voltage at the specified surge current. Tested life under these conditions shall be no less than 4,000 impulses per mode.
4. UL1449 Voltage Protection Rating. All suppression filter system clamping voltages shall be in compliance and listed by UL1449. Maximum listed clamping voltages shall be as follows:
 - a. Unit shall provide maximum UL1449 3rd Edition Voltage Protection Rating (VPR) for 208Y/120 Volt systems as follows:
 - L-N = 600V
 - L-G = 700V
 - N-G = 600V
 - L-L = 900V
 - b. Unit shall provide maximum UL1449 3rd Edition Voltage Protection Rating (VPR) for 480Y/277 Volt systems as follows:
 - L-N = 1000V
 - L-G = 1000V
 - N-G = 900V
 - L-L = 1800V
5. Noise Attenuation. The unit shall be UL1283 Listed in Type 2 locations as an electromagnetic interference filter. The filter shall provide 30dB at 100kHz, 60dB at 500kHz, 40dB at 1MHz, 12dB at 10MHz, per 50 Ohm Insertion Loss Methodology from MIL 220A. The system shall provide up to 120-dB insertion loss from 100 kHz to 100 MHz when used in a coordinated facility system.
6. Overcurrent Protection. Each suppression element shall be individually fused such that the failure of a single component or the operation of a single fuse element remains isolated and does not render the entire mode, or product, deficient by more than 5%. Fusing shall be present in all modes, including Neutral-to-Ground. The device shall be capable of withstanding the full single pulse surge current capacity for every mode without the operation or failure of overcurrent / fault current protection or fuses.

2.4 BRANCH PANEL (100 amperes to 225 amperes) Protective DEVICE

- A. General
 1. Unit Operating Voltage. The nominal unit operating voltage and configuration shall be as indicated on the drawings.
 2. Maximum Continuous Operating Voltage (MCOV). The MCOV shall be greater than 115% of nominal voltage for all products.
 3. Operating frequency range shall be 47-63 Hertz.
 4. Surge rating shall be 65kA per Mode
 5. Monitoring: Status LED's and Form C contacts.
 6. Acceptable Products shall be, no substitutions:
 - a. Current Technology #TG60 Series.
 - b. Liebert #ACV Series.
- B. Physical
 1. Enclosure: The specified system shall be provided in a heavy duty NEMA 4 dust-tight, drip-tight enclosure with no ventilation openings.
 2. Provide a plastic lexan cover with lock for outdoor applications.
- C. Electrical
 1. Unit shall be UL1449, 3rd Edition (September 29, 2009) Type 1 20kA nominal discharge current Listed. A SPD that is a UL "Recognized" component will not be accepted.
 2. Unit shall include solid-state, long-life externally mounted LED visual status indicators that indicate the on-line status and operational integrity of the unit.

3. Unit shall have a Form C summary alarm output contact rated for at least 1 amp at 120VAC for remote annunciation of SPD status.
- D. Performance
 1. Rated Single Pulse Surge Current Capacity. The rated single pulse surge current capacity, in amps, for each mode of protection of the unit shall be no less than 65,000 Amps per mode.
 2. Tested Single Pulse Surge Current Capacity. Suppression filter systems shall be single pulse surge current tested in all modes at rated surge currents by an industry-recognized independent test laboratory. The test shall include a UL1449 Third Edition surge defined as a 1.2 X 50 μ sec, 6000V open circuit voltage waveform and an 8X20 μ sec, 3000A short circuit current waveform to benchmark the unit's suppression voltage, followed by a single pulse surge of maximum rated surge current magnitude with an 8X20 μ sec waveform. To complete the test, another UL1449 surge shall be applied to verify the unit's survival. Survival is achieved if the suppression voltage measured from the two UL1449 surges does not vary by more than 10%.
 3. Minimum Life Cycle Rating. Per ANSI/IEEE C62.41 and ANSI/IEEE C62.45-1992, Test suppression filter systems in every mode utilizing a 1.2X 50 μ sec, 20 KV open circuit voltage, 8X20 μ sec, 10 KA short circuit current Category C3 bi-wave at one minute intervals without suffering performance degradation of more than 10% deviation of clamping voltage at the specified surge current. Tested life under these conditions shall be no less than 2,500 impulses per mode.
 4. UL1449 Voltage Protection Rating. All suppression filter system clamping voltages shall be in compliance and listed by UL1449. Maximum listed clamping voltages shall be as follows:
 - a. Unit shall provide maximum UL 1449 3rd Edition Voltage Protection Rating (VPR) for 208Y/120 Volt systems as follows:
 - L-N = 600V
 - L-G = 700V
 - N-G = 600V
 - L-L = 900V
 - b. Unit shall provide maximum UL1449 3rd Edition Voltage Protection Rating (VPR) for 480Y/277 Volt systems as follows:
 - L-N = 1000V
 - L-G = 1000V
 - N-G = 900V
 - L-L = 1800V
 5. Noise Attenuation the unit shall be UL 1283 for type 2 locations Listed as an electromagnetic interference filter. The filter shall provide 30dB at 100kHz, 60dB at 500kHz, 40dB at 1MHz, 12dB at 10MHz, per 50 Ohm Insertion Loss Methodology from MIL 220A. The system shall provide up to 120-dB insertion loss from 100 kHz to 100 MHz when used in a coordinated facility system.

2.5 DOCUMENTATION

- A. All non-approved manufacturers shall submit for 10-day pre-approval, and provide detailed compliance or exception statements to all provisions of this specification to allow consideration. Additionally, manufacturers shall submit independent test data from a nationally recognized testing laboratory verifying the following: life cycle testing, overcurrent protection, UL1449, noise attenuation and surge current capacity. Failure to do so will result in product disapproval.

PART 3-EXECUTION

3.1 INSTALLATION AND TESTING

- A. The SPD shall be installed as close as practical to the facility's wiring system in accordance with applicable national/local electrical codes and the manufacturers recommended installation instructions. Cable connections to the bus or disconnect shall utilize cable sized and terminated in accordance with the manufacturer's recommendations. The SPD shall be connected via manufacturers low impedance connection system, installed using the shortest practical cable length, and avoiding all unnecessary bends.
- B. External Conductor Path. All external SPD's shall be connected via a special transient cable, UL approved, which must, through integrated testing with the SPD, reflect a minimum 300% reduction in voltage drop when compared to using standard THW or THHN wire, if length from panel to TVSS unit exceeds 10'0".
- C. Per NEMA Std. 1100-2005, Sec. 8.4.2.5, to eliminate collateral damage in the event of SPD failure, the SPD must be installed external to all switchboards and panelboards.
- D. System Testing: Upon completion of installation, a factory-authorized local service representative shall provide product start-up testing services. The tests shall include:
 - 1. On-Line Testing: verification that all suppression and filtering paths are operating with 100% protection as well as verification of proper facility neutral-to-ground bond by measuring neutral-to-ground current and voltage.
 - 2. Off-line Testing: Impulse injection to verify the system tolerances as well as verification of proper facility neutral-to-ground bond. To be compared to factory benchmark test parameters supplied with each individual unit.
- E. All local and national codes must be observed.

3.2 WARRANTY

- A. The manufacturer shall provide a full ten (10) year parts warranty from date of shipment against any part failure when installed in compliance with manufacturer's written instructions, UL Listing requirements and any applicable national, state or local electrical codes. Manufacturer shall have a direct, factory trained, ISO 9001 certified employees must be available for 48-hour assessment. A 24-hour 800 number must be available to support warranty.

END OF SECTION 264313

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SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.
5. Retrofit kits for fluorescent lighting fixtures.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, and finishes.
- B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.

1.03 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

2.02 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.
- C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

- D. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.
- E. Metal Parts: Free of burrs and sharp corners and edges.
- F. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- G. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- H. Diffusers and Globes:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass unless otherwise indicated.
- I. Air-Handling Fluorescent Fixtures: For use with plenum ceiling for air return and heat extraction and for attaching an air-diffuser-boot assembly specified in Section 233713 "Diffusers, Registers, and Grilles."
 - 1. Air-Supply Units: Slots in one or both side trims join with air-diffuser-boot assemblies.
 - 2. Heat-Removal Units: Air path leads through lamp cavity.
 - 3. Combination Heat-Removal and Air-Supply Unit: Heat is removed through lamp cavity at both ends of the fixture door with air supply same as for air-supply units.
 - 4. Dampers: Operable from outside fixture for control of return-air volume.
 - 5. Static Fixture: Air-supply slots are blanked off, and fixture appearance matches active units.

2.03 BALLASTS FOR LINEAR FLUORESCENT LAMPS

- A. General Requirements for Electronic Ballasts:
 - 1. Comply with UL 935 and with ANSI C82.11.
 - 2. Designed for type and quantity of lamps served.
 - 3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
 - 4. Sound Rating: Class A.
 - 5. Total Harmonic Distortion Rating: Less than 10 percent.
 - 6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 - 7. Operating Frequency: 42 kHz or higher.
 - 8. Lamp Current Crest Factor: 1.7 or less.
 - 9. BF: 0.88 or higher.
 - 10. Power Factor: 0.95 or higher.
- B. Luminaires controlled by occupancy sensors shall have programmed-start ballasts.
- C. Electromagnetic Ballasts: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.
 - 1. Ballast Manufacturer Certification: Indicated by label.

- D. Single Ballasts for Multiple Lighting Fixtures: Factory wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.
- E. Ballasts for Low-Temperature Environments: Electronic or electromagnetic type rated for 0 deg F (minus 17 deg C) starting and operating temperature with indicated lamp types.
- F. Ballasts for Residential Applications: Fixtures designated as "Residential" may use low-power-factor electronic ballasts having a Class B sound rating and total harmonic distortion of approximately 30 percent.
- G. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.
 - 1. Dimming Range: 100 to 5 percent of rated lamp lumens.
 - 2. Ballast Input Watts: Can be reduced to 20 percent of normal.
 - 3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.
 - 4. Control: Coordinate wiring from ballast to control device to ensure that the ballast, controller, and connecting wiring are compatible.
- H. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic type.
 - 1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.
 - a. High-Level Operation: 100 percent of rated lamp lumens.
 - b. Low-Level Operation: 30 percent of rated lamp lumens.
 - 2. Ballast shall provide equal current to each lamp in each operating mode.
 - 3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.

2.04 BALLASTS FOR COMPACT FLUORESCENT LAMPS

- A. Description: Electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:
 - 1. Lamp end-of-life detection and shutdown circuit.
 - 2. Automatic lamp starting after lamp replacement.
 - 3. Sound Rating: Class A.
 - 4. Total Harmonic Distortion Rating: Less than 20 percent.
 - 5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 - 6. Operating Frequency: 20 kHz or higher.
 - 7. Lamp Current Crest Factor: 1.7 or less.
 - 8. BF: 0.95 or higher unless otherwise indicated.
 - 9. Power Factor: 0.95, except fixtures designated as "Residential" may use low-power-factor electronic ballasts or higher.
 - 10. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

2.05 EMERGENCY FLUORESCENT POWER UNIT

- A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.

1. Emergency Connection: Operate one fluorescent lamp(s) continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
2. Nightlight Connection: Operate one fluorescent lamp continuously.
3. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
4. Battery: Sealed, maintenance-free, nickel-cadmium type.
5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.06 BALLASTS FOR HID LAMPS

- A. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features unless otherwise indicated:
 1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
 2. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C) for single-lamp ballasts.
 3. Rated Ambient Operating Temperature: 104 deg F (40 deg C).
 4. Open-circuit operation that will not reduce average life.
 5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.
- B. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:
 1. Minimum Starting Temperature: Minus 20 deg F (Minus 29 deg C) for single-lamp ballasts.
 2. Rated Ambient Operating Temperature: 130 deg F (54 deg C).
 3. Lamp end-of-life detection and shutdown circuit.
 4. Sound Rating: Class A.
 5. Total Harmonic Distortion Rating: Less than 20 percent.
 6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 7. Lamp Current Crest Factor: 1.5 or less.
 8. Power Factor: 0.90 or higher.
 9. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
 10. Protection: Class P thermal cutout.

2.07 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
 1. Lamps for AC Operation: Fluorescent, two for each fixture, 20,000 hours of rated lamp life.
 2. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
 3. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

- a. Battery: Sealed, maintenance-free, nickel-cadmium type.
- b. Charger: Fully automatic, solid-state type with sealed transfer relay.
- c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
- d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
- e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.08 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
7. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.

2.09 FLUORESCENT LAMPS

- A. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches (1220 mm), 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life 20,000 hours unless otherwise indicated.
- B. T8 rapid-start lamps, rated 17 W maximum, nominal length of 24 inches (610 mm), 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life of 20,000 hours unless otherwise indicated.
- C. Compact Fluorescent Lamps: 4-Pin, CRI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at three hours operation per start, and suitable for use with dimming ballasts where indicated.
 1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
 2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
 3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
 4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
 5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).
 6. 57 W: T4, triple tube, rated 4300 initial lumens (minimum).
 7. 70 W: T4, triple tube, rated 5200 initial lumens (minimum).

2.10 HID LAMPS

- A. Metal-Halide Lamps: ANSI C78.43, with minimum CRI 65, and color temperature 4000 K.

2.11 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Section 260529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).
- E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).
- F. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
- G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

2.12 RETROFIT KITS FOR FLUORESCENT LIGHTING FIXTURES

- A. Reflector Kit: UL 1598, Type I. Suitable for two- to four-lamp, surface-mounted or recessed lighting fixtures by improving reflectivity of fixture surfaces.
- B. Ballast and Lamp Change Kit: UL 1598, Type II. Suitable for changing existing ballast, lamps, and sockets.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Comply with NFPA 70 for minimum fixture supports.
- C. Suspended Lighting Fixture Support:
 - 1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 - 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
- D. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.
- E. Adjust aimable lighting fixtures to provide required light intensities.
- F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.02 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

END OF SECTION 265100

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SECTION 265600 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Exterior luminaires with lamps and ballasts.
2. Luminaire-mounted photoelectric relays.
3. Poles and accessories.

1.02 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

- A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.
- B. Live Load: Single load of 500 lbf (2224 N), distributed as stated in AASHTO LTS-4-M.
- C. Ice Load: Load of 3 lbf/sq. ft. (145 Pa), applied as stated in AASHTO LTS-4-M Ice Load Map.
- D. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-4-M.
1. Basic wind speed for calculating wind load for poles exceeding 49.2 feet (15 m) in height is 100 mph (45 m/s).
 - a. Wind Importance Factor: 1.0.
 - b. Minimum Design Life: 50 years.
 - c. Velocity Conversion Factors: 1.0.

1.03 ACTION SUBMITTALS

- A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, and finishes.
- B. Shop Drawings: Anchor-bolt templates keyed to specific poles and certified by manufacturer.

1.04 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with IEEE C2, "National Electrical Safety Code."
- C. Comply with NFPA 70.
- D. Comply with material and sourcing requirements of Ohio Housing Finance Agency (OHFA), U.S. Department of Housing and Urban Development (HUD), and Build America, Buy America (BABA).

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

2.02 GENERAL REQUIREMENTS FOR LUMINAIRES

- A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
 - 1. LER Tests Incandescent Fixtures: Where LER is specified, test according to NEMA LE 5A.
 - 2. LER Tests HID Fixtures: Where LER is specified, test according to NEMA LE 5B.
- B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
- G. Exposed Hardware Material: Stainless steel.
- H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.
- J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
- K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

- M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
 - 2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: As selected from manufacturer's standard catalog of colors.
 - b. Color: Match Architect's sample of manufacturer's standard color.
 - c. Color: As selected by Architect from manufacturer's full range.
- N. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 - 2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
 - 3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
 - 4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
- O. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 - 1. Label shall include the following lamp and ballast characteristics:
 - a. "USES ONLY" and include specific lamp type.
 - b. Lamp tube configuration (twin, quad, triple), base type, and nominal wattage for compact fluorescent luminaires.
 - c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
 - d. Start type (preheat, rapid start, instant start) compact fluorescent luminaires.
 - e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
 - f. CCT and CRI for all luminaires.

2.03 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

- A. Comply with UL 773 or UL 773A.
- B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay.
 - 1. Relay with locking-type receptacle shall comply with ANSI C136.10.
 - 2. Adjustable window slide for adjusting on-off set points.

2.04 FLUORESCENT BALLASTS AND LAMPS

A. Ballasts for Low-Temperature Environments:

1. Temperatures 0 Deg F (Minus 17 Deg C) and Higher: Electronic or electromagnetic type rated for 0 deg F (minus 17 deg C) starting and operating temperature with indicated lamp types.
2. Temperatures Minus 20 Deg F (Minus 29 Deg C) and Higher: Electromagnetic type designed for use with indicated lamp types.

B. Ballast Characteristics:

1. Power Factor: 90 percent, minimum.
2. Sound Rating: Class A.
3. Total Harmonic Distortion Rating: Less than 10 percent.
4. Electromagnetic Ballasts: Comply with ANSI C82.1, energy-saving, high power factor, Class P, automatic-reset thermal protection.
5. Case Temperature for Compact Lamp Ballasts: 65 deg C, maximum.
6. Transient-Voltage Protection: Comply with IEEE C62.41.1 and IEEE C62.41.2, Category A or better.

C. Low-Temperature Lamp Capability: Rated for reliable starting and operation with ballast provided at temperatures [0 deg F (minus 18 deg C)] [minus 20 deg F (minus 29 deg C)] and higher.

2.05 BALLASTS FOR HID LAMPS

A. Comply with ANSI C82.4 and UL 1029 and capable of open-circuit operation without reduction of average lamp life. Include the following features unless otherwise indicated:

1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
2. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C).
3. Normal Ambient Operating Temperature: 104 deg F (40 deg C).
4. Ballast Fuses: One in each ungrounded power supply conductor. Voltage and current ratings as recommended by ballast manufacturer.

2.06 HID LAMPS

A. Metal-Halide Lamps: ANSI C78.43, with minimum CRI 65, and CCT color temperature 4000 K.

2.07 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

A. Structural Characteristics: Comply with AASHTO LTS-4-M.

1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

- C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
 - 1. Materials: Shall not cause galvanic action at contact points.
 - 2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
 - 3. Anchor-Bolt Template: Plywood or steel.
- D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches (65 by 130 mm), with cover secured by stainless-steel captive screws.
- E. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."
- F. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.
- G. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4-M.

2.08 STEEL POLES

- A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig (317 MPa); one-piece construction up to 40 feet (12 m) in height with access handhole in pole wall.
 - 1. Shape: Round, tapered, unless indicated otherwise.
 - 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
- B. Steel Mast Arms: Continuously welded to pole attachment plate. Material and finish same as pole.
- C. Brackets for Luminaires: Detachable, cantilever, without underbrace.
 - 1. Adapter fitting welded to pole, allowing the bracket to be bolted to the pole mounted adapter, then bolted together.
 - 2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
 - 3. Match pole material and finish.
- D. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- E. Steps: Fixed steel, with nonslip treads, positioned for 15-inch (381-mm) vertical spacing, alternating on opposite sides of pole; first step at elevation 10 feet (3 m) above finished grade.
- F. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- G. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.
- H. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.
- I. Galvanized Finish: After fabrication, hot-dip galvanize complying with ASTM A 123/A 123M.

- J. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."
 2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
 3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: As selected by Architect from manufacturer's full range.

2.09 ALUMINUM POLES

- A. Poles: Seamless, extruded structural tube complying with ASTM B 429/B 429M, Alloy 6063-T6 with access handhole in pole wall.
- B. Poles: ASTM B 209 (ASTM B 209M), 5052-H34 marine sheet alloy with access handhole in pole wall.
1. Shape: Round, tapered unless noted otherwise.
 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
- C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- D. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- E. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.
1. Tapered oval cross section, with straight tubular end section to accommodate luminaire.
 2. Finish: Same as pole.
- F. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.
- G. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
 3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
 4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.01 LUMINAIRE INSTALLATION

- A. Install lamps in each luminaire.
- B. Fasten luminaire to indicated structural supports.
 - 1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Adjust luminaires that require field adjustment or aiming. Include adjustment of any photoelectric devices to prevent false operation of relay by artificial light sources, favoring a north orientation.

3.02 POLE INSTALLATION

- A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.
- B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:
 - 1. Fire Hydrants and Storm Drainage Piping: 60 inches (1520 mm).
 - 2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet (3 m).
 - 3. Trees: 15 feet (5 m) from tree trunk.
- C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer.
- D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
 - 1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
 - 2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
 - 3. Install base covers unless otherwise indicated.
 - 4. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
- E. Embedded Poles with Tamped Earth Backfill: Set poles to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.
 - 1. Dig holes large enough to permit use of tampers in the full depth of hole.
 - 2. Backfill in 6-inch (150-mm) layers and thoroughly tamp each layer so compaction of backfill is equal to or greater than that of undisturbed earth.
- F. Embedded Poles with Concrete Backfill: Set poles in augered holes to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.
 - 1. Make holes 6 inches (150 mm) in diameter larger than pole diameter.
 - 2. Fill augered hole around pole with air-entrained concrete having a minimum compressive strength of 3000 psi (20 MPa) at 28 days, and finish in a dome above finished grade.

3. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through concrete dome. Arrange to drain condensation from interior of pole.
 4. Cure concrete a minimum of 72 hours before performing work on pole.
- G. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch- (150-mm-) wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch (25 mm) below top of concrete slab.
- H. Raise and set poles using web fabric slings (not chain or cable).

3.03 BOLLARD LUMINAIRE INSTALLATION

- A. Align units for optimum directional alignment of light distribution.
- B. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at bollard location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth.

3.04 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.05 GROUNDING

- A. Ground metal poles and support structures according to Section 260526 "Grounding and Bonding for Electrical Systems."
1. Install grounding electrode for each pole unless otherwise indicated.
 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.
- B. Ground nonmetallic poles and support structures according to Section 260526 "Grounding and Bonding for Electrical Systems."
1. Install grounding electrode for each pole.
 2. Install grounding conductor and conductor protector.
 3. Ground metallic components of pole accessories and foundations.

END OF SECTION 265600

SECTION 26 81 15 - EMERGENCY RESPONDER RADIO ANTENNA/REPEATER SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION

- A. Allowance: The Division 26 Contractor shall include in his/her Bid an allowance of \$2 per square foot to furnish and install a complete emergency responder radio antenna/repeater system. The Division 26 Contractor shall provide actual invoice of charges and shall provide credit to Owner if charges are less than the allowance. If actual invoice is greater, the Division 26 Contractor shall submit a change order for the additional charge over the allowance.
- B. Furnish, install, and test a complete and operating Emergency Responder Radio Antenna/Repeater System. The system will support the Fire Department radio system and other first responders. The system is not intended to support cell phone carriers or the Owner's private security and/or maintenance personnel radio systems, now or in the future.
- C. This Section includes the requirements for an Emergency Responder Radio Antenna/Repeater System for the purposes of amplifying Emergency Responder radio signals to achieve minimum signal strength in 95% of all areas on each floor of the building. The contractor shall contact the authority having jurisdiction and obtain the current communications frequency.
- D. Final acceptance and approval are required from the local Fire Department and other first responders in writing prior to contract closeout. If the system is capable of operating on a frequency that is licensed to a public service agency by the FCC, it cannot be installed without prior coordination and approval of the fire code official.
- E. Section Includes
 - 1. Bi-directional amplifiers (BDA's)
 - 2. Distributed Antenna System
 - 3. Coaxial cables
 - 4. Splitters and direction couplers
 - 5. UPS
 - 6. All other equipment and components necessary for a complete and functioning Emergency Responder Radio Antenna/Repeater System.

1.02 STANDARDS

- A. Codes, regulations and standards referenced in the Section are:
 - 1. NFPA 1 – The National Fire Code (including Annex O)
 - 2. NFPA 70 – The National Electrical Code
 - 3. Ohio Fire Code, Rule 1301:7-7-05 Fire Service Features, Paragraph J, Section 510 Emergency Responder Radio Coverage
 - 4. NFPA 101, Life Safety Code, the Ohio Basic Building Code, and Local Code and Building Authority requirements.
 - 5. NFPA 72-16 National Fire Alarm Code
 - 6. FCC 47 CFR Private Land Mobile Radio
 - 7. 90.219-2007 Services-Use of Signal Boosters
 - 8. ICC International Fire Code, Code and Commentary
 - 9. Ohio Fire Code

10. ADA "Americans with Disabilities Act"
11. FCC's OET 65 Standards "Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields".
12. FCC Rules Part 22, Part 90 and Part 101.
13. International Fire Code, Section 510.

1.03 DEFINITIONS

A. Definitions:

1. Bi-Directional Amplifier BDA: Device used to amplify band-selective or multi-band RF signals in the uplink, to the base station for enhanced signals and improved coverage.
2. Emergency Responder Radio Coverage System: A two-way radio communication system installed to assure the effective operation of radio communications systems for fire, emergency medical services or law enforcement agencies within a building or structure. A system used by firefighters, police, and other emergency services personnel.
3. Delivered Audio Quality Definitions (DAQ): This is a universal standard often cited in system designs and specifications.
 - a. DAQ 1: Unusable, speech present but unreadable.
 - b. DAQ 2: Understandable with considerable effort. Frequent repetition due to noise/distortion.
 - c. DAQ 3: Speech understandable with slight effort. Occasional repetition required due to noise/distortion.
 - d. DAQ 3.5: Speech understandable with repetition only rarely required. Some noise/distortion
 - e. DAQ 4: Speech easily understood. Occasional noise/distortion.
 - f. DAQ 4.5: Speech easily understood. Infrequent noise/distortion.
 - g. DAQ 5: Speech easily understood. Coupled Bonding Conductor (CBC) – The term "Coupled Bonding Conductor" shall mean a bonding conductor placed, e.g. strapped, on the outside of any technology cable, used to suppress transient noise.
4. FCC: Federal Communications Commission
5. OET 65 Standards: FCC's Bulletin 65 provides Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.
6. Public Safety/First Responder: Public Safety or First Responder agencies which are charged with the responsibility of responding to emergency situations. These include, but are not limited to: law enforcement departments, fire departments, and emergency medical companies.

1.04 SUBMITTALS

- #### A. Submit product data for each type of proposed system component specified, including dimensioned drawings showing minimum clearances and installed features.
- #### B. Layout Drawings
1. Component specification sheets shall be 8.5 inch x 11 inch or greater, scaled or dimensioned, with dimensions or scale clearly noted.
 2. Floor plan drawings shall be 24 inch x 36 inch minimum with drawings scaled to legible size.

3. Floor plan drawings may include elevation detail names for each elevation view. Sheet title shall include site name, address, sheet number, floor plan number and north arrow. Include site plan view of the subject buildings and surrounding property to clearly indicate the location and orientation of roof mounted outdoor antennas associated with the proposed system.
 4. Include a minimum of (1) building elevation depicting the location of any outdoor antennas associated with the proposed system. Include height of antenna centerline above building, orientation, and location of all external grounding connections.
 5. Include a detail plan view of all Telecommunications Spaces housing head-end and/or other consolidated equipment, showing the location of the rack(s) and/or enclosure(s) of the Emergency Responder Radio Antenna/Repeater System equipment.
 6. Include a separate plan view of each interior floor where indoor antenna systems are proposed. Include antenna numbers, coaxial cable routes, and the locations of any other system components including splitters, couplers, filters, amplifiers, etc. All components shall be named or labeled for reference in power budget calculations tables. Overlay approximated coverage radii indicating -95 dBm downlink (base to mobile) signal strength around each proposed indoor coverage antenna. Include results of any previous coverage testing per grid, if available.
 7. Include a minimum of one (1) detail elevation view(s) of all rack(s) and/or enclosure(s) housing the Emergency Responder Radio Antenna/Repeater System equipment. Identify each piece of equipment by brand, model number and equipment type (e.g. Acme BA123 RF amplifier).
 8. Specify antenna grounding and surge protection in accordance with NEC Article 810.
 9. Specify the backup power source (Life Safety), and include calculations to ensure the backup power requirements as specified in this standard are met.
- C. Equipment Specification Sheets
1. Provide copies of manufacturer specification sheets of all system components, including:
 - a. Amplifiers
 - b. Antennas
 - c. Coaxial cable, couplers, splitters, combiners, or other passive components
 2. Operation and maintenance data
 3. Pass band curves in for the uplink and downlink portions of the NPSPAC band for any amplifiers, if not included in #1. Amplifiers may NOT amplify portions of other licensed services, including Nextel and Specialized Mobile Radio Licensee band, or Cellular A or B bands.
 4. Backup battery and charging system.
- D. Submit wiring diagrams from manufacturer differentiating clearly between factory and field-installed wiring. Include diagrams for each component of the system with all terminals and interconnections identified. Make all diagrams specific to this Project.
- E. Submit product certificates signed by the manufacturer of radio system components certifying that their products comply with specified requirements.
- F. Submit agenda for training class and copies of all handouts for the class.
- G. Maintenance data for radio system shall be included in the operation and maintenance manual. Include data for each type of product, including all features and operating sequences, both automatic and manual. Provide the names, addresses, and telephone numbers of service organizations that carry stock of repair parts for the system to be furnished.

- H. Record of field tests of the radio system shall be included in the operation and maintenance manuals.
- I. Design Approval: Plans shall be submitted and approved prior to installation. The following information shall be provided to the local Fire Department unit representative by the system designer/Contractor:
 - 1. A minimum of three (3) copies of detailed drawings showing the location of the amplification equipment and associated antenna systems which includes a view showing building access to the equipment; and
 - 2. A minimum of three (3) copies of schematic drawings of the electrical system, backup power, antenna system and any other associated equipment relative to the amplification equipment including panel locations and labeling.
 - 3. A minimum of one (1) copy of the Manufacturer's data sheets on all equipment to be installed.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: The lead installation personnel shall have a valid FCC-issued general radio operators license and shall have a certification of in-building system training issued by a nationally recognized organization, school or a certificate issued by the manufacturer of the equipment being installed. Engage an experienced factory-authorized installer to perform work of this Section.
- B. Designer Qualifications: The system designer shall have a valid FCC-issued general radio operators license and shall have a certification of in-building system training issued by a nationally recognized organization, school or a certificate issued by the manufacturer of the equipment being installed.
- C. Single-Source Responsibility: Obtain radio system components from a single source who assumes responsibility for compatibility of system components.
- D. All equipment shall be UL listed and labeled, and in accordance with applicable NEMA and ANSI Standards. Where copper cabling is routed to an area, either in another building, or with a separate electrical service, the Technology Contractor shall provide primary protective equipment.
- E. All racks and enclosures shall be either welded or assembled with paint piercing ground washers, grounding strip and bonding jumper as indicated on the Drawings.

1.06 MANUFACTURERS

- A. Subject to compliance with requirements, available Integrators offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Comba
 - 2. Honeywell
 - 3. Corning
 - 4. Zinwave
 - 5. CommScope/Andrews
 - 6. Engineer-approved equivalent

PART 2 PRODUCTS

2.01 GENERAL PERFORMANCE REQUIREMENTS

- A. Compatibility: The equipment, including but not limited to repeaters, transmitters, receivers, signal boosters, cabling, fiber distributed antenna system, etc., shall not interfere with the existing communication systems utilized by the Public Safety and First Responder agencies.
- B. Power Supplies: At least two (2) independent and reliable power supplies shall be provided, one primary and one secondary. The primary power source shall be supplied from a dedicated 20 ampere branch circuit and comply with 10.6.5 of NFPA 72. The secondary power source shall be a dedicated battery, capable of operating the in-building radio system for at least 24 hours of 100% system operation. The battery system shall automatically charge in the presence of external power input. The battery system shall be contained in a NEMA 4-type waterproof enclosure. Monitoring the integrity of power supplies shall be in accordance with 10.6.9 of NFPA 72.
- C. Survivability
 - 1. Physical Protection: All wiring and fiber optics shall be installed in conduit. Refer to Section 26 05 33, "Conduit and Fittings" for type, sizing and installation standards.
 - 2. Fire Performance: All main risers or trunks of the antenna system shall be installed with resistance to attack from a fire using one of the following methods:
 - a. A 2-hour fire rated cable or cable system.
 - b. Routing the cable through a 2-hour fire rated enclosure(s) or shaft(s).
 - c. A system configured in a looped design, routed through 1-hour fire rated enclosure(s) or shaft(s). The circuit shall be capable of transmitting and receiving a signal during a single open or non-simultaneous single ground fault on a circuit conductor.
 - d. Performance alternative approved by the authority having jurisdiction.
 - 3. Cabinet: The signal booster and all associated RF filters shall be housed in a single, NEMA 4 certified, painted steel weather tight box. The cabinet shall be large enough to dissipate internal heat without venting the inside of the cabinet to the outside atmosphere. Operating temperatures: -22 degrees F to +120 degrees F (-30 degrees C to +50 degrees C) minimum temperature range, including microprocessors. Equipment installed on the roof of structures shall be rated for the expected extreme temperatures associated with rooftop installations.
 - 4. Passive Equipment: Passband shall be 700-900 MHz, IP rating of 2 GHz.
 - 5. Cable: Passband shall be 700-900 MHz. Cable shall be rated for fire plenum and riser rating.
- D. Future Expansion
 - 1. The system shall be capable of modification or expansion to enable the system to adapt to frequency changes or additions required or made available by the FCC.

2.02 SYSTEM COMPONENTS

- A. Signal Strength
 - 1. Downlink: A minimum signal strength of -95 dBm shall be provided throughout the coverage area.
 - 2. Uplink: Minimum signal strength of -95 dBm received at the local Fire Department Radio System from the coverage area.

3. A donor antenna must maintain isolation from the distributed antenna system. The donor antenna signal level shall be a minimum of 15 dB above the distributed antenna system under all operating conditions.
- B. Permissible Systems
 1. Buildings and structures shall be equipped with an FCC Certificated Class B Bi-Directional UHF Amplifier(s) as needed.
- C. Supported Frequencies: The radio system shall support frequencies in the 700 and 800 MHz public safety bands as utilized by the local Fire Department.
- D. Reject Filters: Notch filter sections shall be incorporated to minimize adjacent channel cellular and SMR (Nextel) degradation of the signal booster performance. The minimum downlink band adjacent band rejection shall be 35 dB or greater at 865 MHz and 870 MHz.
- E. Band Migration Capability: The signal booster shall include re-tunable or replaceable filters to accommodate rapid and economic passband changes in the event of mandatory FCC changes within the NPSPAC band. The use of non-adjustable and non-replaceable RF input and output filters is prohibited.
- F. Output Level Control: An automatic output leveling circuit shall be included for both passbands with a minimum dynamic range of 60 dB, less any gain reduction setting, to maintain FCC out of band and spurious emission compliance.
- G. Degraded Performance in Emergencies: The system shall be designed to allow degraded performance in adverse conditions, such as abnormally high temperatures resulting from nearby fires, extreme voltage fluctuations or other abnormal conditions that may occur during an emergency. Circuits that intentionally disable the signal booster in such situations (i.e. under/over voltage, over/under current, over/under temperature, etc.) will not be implemented as the standard mode for public safety applications.
- H. Mode of Operation: The system shall be normally powered on and shall continuously provide passing of frequencies within the Public Safety and First Responder bands.
- I. All in-building radio systems shall be compatible with both analog and digital communications simultaneously at the time of installation.

2.03 SYSTEM MONITORING

- A. The distributed antenna system shall include a connection to the fire alarm system to monitor the integrity of the circuit of the signal booster(s) and power supplies; monitored connection shall comply with 12.6 of NFPA 72. Any connection malfunction shall annunciate on the fire alarm system.
- B. A sign shall be located at the fire alarm panel with the name and telephone number of the local Fire Department indicating that they shall be notified of any failures that extend past the 2 hour time limit.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Distribution System Signal Wires and Cables
 - 1. Wires and cables shall enter each equipment enclosure, console, cabinet or rack in such a manner that all doors or access panels can be opened and closed without removal or disruption of the cables.
 - 2. Routing and Interconnection
 - a. Wires or cables routed between consoles, cabinets, racks, and other equipment shall be installed in an approved conduit or cable tray that is secured to building structure.
 - b. Completely test all of the cables after installation and replace any that are found to be defective.
 - 3. Install cables without damaging conductors, shield, or jacket.
 - 4. Do not bend cables, while handling or installing, to radii smaller than as recommended by manufacturer.
 - 5. Pull cables without exceeding cable manufacturer's recommended pulling tensions.
- B. Product Delivery, Storage, and Handling
 - 1. Delivery: Deliver materials to the job site in OEM's original unopened containers, clearly labeled with the OEM's name and equipment model and serial identification numbers.
 - 2. Store and protect equipment in a conditioned space until installation.
- C. System Installation
 - 1. Coaxial antenna cabling shall not be installed in the same conduit, raceway, or cable trays used for other systems. Run separately attached to building structure.
 - 2. All equipment shall be connected according to the OEM's specifications to insure correct installation and system performance.
 - 3. Coordinate all roof penetrations with Owner and/or roofing contractor.
 - 4. Install DAS equipment cabinet in the telecom room located on the top floor of the building. Panels 120 volt branch circuits from emergency system as required,

3.02 LICENSING

- A. All fees associated with the licensing shall be paid by the Owner.
- B. All testing must be done on frequencies authorized by the FCC.

3.03 GROUNDING

- A. Ground cable shields and equipment per Manufacturer's requirements.
- B. Antenna mast shall be grounded per NFPA 70 NEC requirements, Section 26 05 27, "Telecommunications Bonding Infrastructure" and antenna manufacturer's requirements. Provide grounding blocks and surge protection for outside coaxial cabling. Bond the antenna mast to the existing lightning protection system.

3.04 APPROVAL TESTING

- A. The local Fire Department will review plans and specifications. Upon acceptance, plans will be stamped to indicate approval. Stamped plans are required to be present at the acceptance test. Any field changes that occur during construction shall be incorporated into new As-Built plans, including any manufacturer's data sheets for any equipment changes not submitted in the original submittal. As-Built plans, if required due to system changes, shall be submitted to the local Fire Department for approval.
- B. Tests shall be made using frequencies close to the frequencies used by the Fire Department and appropriate emergency services. If testing is done on the actual frequencies, then this testing must be coordinated with the local Fire Department unit. All testing must be done on frequencies authorized by the FCC. A valid FCC license will be required if testing is done on frequencies different from the police, fire or emergency medical frequencies.
- C. Testing Procedures
 - 1. Minimum Signal Strength: For testing system signal strength and quality, the testing shall be based on the delivered audio quality (DAQ) system. A DAQ level below 3.0 shall be considered a failed test for a given grid cell.
 - 2. Measurements shall be made with the antenna held in a vertical position at 3 to 4 feet above the floor to simulate a typical portable radio worn on the belt or turnout coat pocket.
- D. Final Acceptance Testing
 - 1. Where an emergency responder radio coverage system is required, and upon completion of installation, the radio system shall be tested to verify that two-way coverage on each floor of the building is not less than 90%. The test procedure shall be conducted as follows:
 - a. Each floor of the building shall be divided into a grid of 20 approximately equal test areas.
 - b. The test shall be conducted using a calibrated portable radio of the latest brand and model used by the agency talking through the agency's radio communications system.
 - c. Failure of more than two nonadjacent test areas shall result in failure of the test.
 - d. In the event that three of the test areas fail the test, in order to be more statistically accurate, the floor shall be permitted to be divided into 40 equal test areas. Failure of more than four nonadjacent test areas shall result in failure of the test. If the system fails the 40-area test, the system shall be altered to meet the 90% coverage requirement.
 - e. A test location approximately in the center of each test area shall be selected for the test, with the radio enabled to verify two-way communications to and from the outside of the building through the public agency's radio communications system. Once the test location has been selected, that location shall represent the entire test area. Failure in the selected test location shall be considered failure of that test area. Additional test locations shall not be permitted.
 - f. The gain values of all amplifiers shall be measured and the test measurement results shall be kept on file with the building owner so that the measurements can be verified during annual tests. In the event that the measurement results become lost, the building owner shall be required to rerun the acceptance test to reestablish the gain values.

- g. As part of the installation, a spectrum analyzer or other suitable test equipment shall be utilized to ensure spurious oscillations are not being generated by the subject signal booster. This test shall be conducted at the time of installation and subsequent annual inspections.
2. All acceptance testing shall be done in the presence of a local Fire Department representative or by the local Fire Department unit at no expense to the City.
3. Small scale drawings (11 inch x 17 inch maximum) of the structure shall be provided by the Contractor to the Owner. The plans shall show each floor divided into the grids as described above, and the results of the pre-testing. Each grid shall be labeled to indicate the DAQ result from the final acceptance testing.
4. The Contractor shall provide the latest approved plans for the system, including any manufacture's data sheets for any equipment changes not submitted in the original submittal to the Owner.
5. Include testing results of the repeater (output wattage, gain level, etc.) and connection to the fire alarm.

3.05 MAINTENANCE AND ANNUAL TESTING

- A. Annual tests will be conducted by the local Fire Department unit or authorized company.
 1. The re-testing will be done at no expense to the City or the appropriate emergency services departments as required in the original testing procedures.
- B. Maintenance Contract
 1. Maintenance contract with a Radio Service Provider in place with name of authorized company, who will provide a 24 hour by 7 day emergency response within two (2) hours after notification. The system shall be maintained in accordance with FCC requirements. The contract shall be for 5 years.
 2. All tests shall be conducted, documented, and signed by a person in possession of a current FCC General Radio Telephone Operator License, or a technician certification issued by the Association of Public-Safety Communications Officials International (APCO) or equivalent as determined by the local Fire Department.
 3. Maintain a list of contact personnel with phone numbers at the radio repeater system cabinet. The contact personnel shall have knowledge of the building and the repeater system and be available to respond to the building in the case of an emergency.
 4. Radio Service Provider maintenance contract shall include but be not limited to:
 - a. Annual Test
 - 1) All active components of the distributed antenna system, including but not limited to amplifier, power supplies, and back-up batteries, shall be tested a minimum of once every 12 months.
 - 2) Amplifiers shall be tested to insure that the gain is the same as it was upon initial installation and acceptance. The original gain shall be noted and any change in gain shall be documented.
 - 3) Back-up batteries and power supplies shall be tested under load for a period of 1 hour to verify that they will operate during an actual power outage. If within the 1-hour test period the battery exhibits symptoms of failure, the test shall be extended for additional 1-hour periods until the integrity of the battery can be determined.
 - 4) Active components shall be checked to determine that they are operating within the manufacturer's specifications for their intended purpose.
 - 5) Documentation of the test shall be maintained on site and a copy forwarded to the local Fire Department Radio Supervisor upon completion of the test.

5. Fire Department Radio personnel, after providing reasonable notice to the Owner or their representative, shall have the right to enter onto the property to conduct field testing to be certain that the required level of radio coverage is present

END OF SECTION

SECTION 26 81 18 - RF SURVEY FOR EMERGENCY RESPONDER RADIO ANTENNA/REPEATER SYSTEM

PART 1 GENERAL

1.01 SUMMARY

- A. Conduct a survey using a RF Spectrum Analyzer to analyze the signal strength of Emergency Responder Radios in the building and determine if amplification of the signal is required.
- B. Survey should be performed after the building is substantially completed.

1.02 DESIGN CRITERIA IF REQUIRED

- A. The RF Performance characteristics of the Owner's facility must be determined prior to initiation of the detailed facility DAS design process.
- B. The System shall distribute Public Safety channels with a signal strength that exceeds the minimum requirements specified by the AHJ. Public Safety includes police services, local and city police, county sheriff, emergency medical services, and fire departments.
- C. The System shall distribute RF coverage at levels outlined below in the following areas of the building(s) — herein specified coverage areas:
 - 1. Floor areas including corridors, lobbies, concourse, and internal spaces
 - 2. Penthouses
 - 3. Bridges/building links
 - 4. Stairwells
 - 5. Elevator lobbies
 - 6. General use spaces (break rooms, staff rooms)
 - 7. Restrooms
 - 8. Exterior public spaces (e.g. courtyards)
- D. The system must have 95 percent coverage of all areas of each building level.
- E. UHF (380-430, 450-512 MHz)
- F. LMR 700/800 MHz - Land Mobile Radio
- G. Frequencies for the following radio systems shall be supported. The DAS vendor shall confirm the frequencies required at the time of facility opening.
 - 1. Federal DHS Trunk
 - 2. Local PD
 - 3. City PD
 - 4. County Sheriff
 - 5. Fire Department
 - 6. Internal Facilities
- H. The System shall have active elements that filter and amplify signals on a frequency specific basis to consistently deliver wireless services at the appropriate power levels.
- I. There shall be no interference between the applications and wireless operators.

1.03 REGULATIONS

- A. Codes, regulations and standards referenced in the Section are:
1. NFPA 1 – The National Fire Code (including Annex O from 2009)
 2. NFPA 70 – The National Electrical Code
 3. Ohio Fire Code, Rule 1301:7-7-05 Fire Service Features, Paragraph J, Section 510- Emergency Responder Radio Coverage
 4. NFPA 101, Life Safety Code, the Ohio Building Code, and Local Code and Building Authority requirements.
 5. NFPA 72 National Fire Alarm Code
 6. FCC 47 CFR Private Land Mobile Radio
 7. 90.219 Services-Use of Signal Boosters
 8. ICC International Fire Code, Code and Commentary
 9. Ohio Fire Code
 10. ADA "Americans with Disabilities Act"
 11. FCC's OET 65 Standards "Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields"
 12. FCC Rules Part 22, Part 90 and Part 101

1.04 DEFINITIONS

- A. Definitions:
1. Bi-Directional Amplifier BDA: Device used to amplify band-selective or multi-band RF signals in the uplink, to the base station for enhanced signals and improved coverage.
 2. Emergency Responder Radio Coverage System: A two-way radio communication system installed to assure the effective operation of radio communications systems for fire, emergency medical services, or law enforcement agencies within a building or structure. A system used by firefighters, police, and other emergency services personnel.
 3. Delivered Audio Quality Definitions (DAQ): This is a universal standard often cited in system designs and specifications.
 - a. DAQ 1: Unusable, speech present but unreadable
 - b. DAQ 2: Understandable with considerable effort. Frequent repetition due to noise/distortion
 - c. DAQ 3: Speech understandable with slight effort. Occasional repetition required due to noise/distortion.
 - d. DAQ 3.5: Speech understandable with repetition only rarely required. Some noise/distortion
 - e. DAQ 4: Speech easily understood. Occasional noise/distortion
 - f. DAQ 4.5: Speech easily understood. Infrequent noise/distortion
 - g. DAQ 5: Speech easily understood. Coupled Bonding Conductor (CBC) – The term "Coupled Bonding Conductor" shall mean a bonding conductor placed, e.g. strapped, on the outside of any technology cable, used to suppress transient noise.
 4. FCC: Federal Communications Commission
 5. OET 65 Standards: FCC's Bulletin 65 provides Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.
 6. Public Safety/First Responder: Public Safety or First Responder agencies that are charged with the responsibility of responding to emergency situations. These include, but are not limited to law enforcement departments, fire departments, and emergency medical companies.
 7. RSSI: Received signal strength indicator RSSI is a measurement of the power present in a received radio signal.

8. BER: Bit Error Rate is the number of bit errors per unit time

1.05 EXECUTION

- A. The RF survey for retrofit facilities can be completed immediately for site specific requirements and RF propagation performance in all frequency bands of interest.
 - 1. Interference sources should be identified, localized to source, and a mitigation plan established.
 - 2. Highly shielded portions of the existing facility must be identified (such as MRI, X-ray, or Faraday cage protected rooms) and a strategy for increasing RF performance in and around these locations must be addressed.
 - 3. An RF heat map must be created which indicates relative RF field strength for each frequency band of interest.
 - 4. Space planning surveys must be completed which identify where all active and passive components will be installed.
- B. The RF survey for new construction facilities may have a preliminary design completed for the purpose of budgetary projections; however, all final radiating device locations should not be determined until the following infrastructure is in place and an RF survey is completed:
 - 1. Structural elements impacting RF absorption, shielding and reflectivity such as walls, and ceiling are in place.
 - 2. Window tint treatments (due to their shielding characteristics) have been completed.
- C. For both retrofit and new construction, tests shall be made using frequencies close to the frequencies used by the Fire Department and appropriate emergency services. If testing is done on the actual Fire Department frequencies, then this testing must be coordinated with the Local Fire Department unit. All testing must be done on frequencies authorized by the FCC. A valid FCC license will be required if testing is done on frequencies different from the police, fire, or emergency medical frequencies.
- D. Testing Procedures
 - 1. Minimum Signal Strength: For testing system signal strength and quality, the testing shall be based on the delivered audio quality (DAQ) system. A DAQ level below 3.0 shall be considered a failed test for a given grid cell.
 - 2. If measurements are done without the fire department equipment, the measurement shall be made with the antenna held in a vertical position at 3 to 4 feet above the floor to simulate a typical portable radio worn on the belt or turnout coat pocket.
 - 3. A minimum signal strength of -95 dBm shall be provided throughout the coverage area for both uplink and downlink by the Local Fire Department.
 - a. RSSI measurement
 - b. BER testing
- E. Tools used for RF survey completion:
 - 1. The RF spectrum analyzer is the most accurate survey tool available and will provide detailed and discrete RF signal levels in each frequency band of interest.
 - 2. Software based survey tools are becoming more useful for projecting propagation analysis and creating graphical analysis such as heat maps based on actual RF spectrum field measurement data input by survey personnel.
 - 3. RF Communication Service monitors and RF field strength meters may be utilized to determine signal coverage within an area.

4. Hand held RF transceivers and cell phones may be used to determine signal level in their specific channel; however, this would be considered a basic survey and should not be utilized as the survey basis for design.
5. RF signal sources and carrier generators may be used to simulate the presence of an RF signal in order to model a facility propagation study and survey.

F. Acceptable manufacturers of testing equipment: Spectrum Analyzers, JDSU, Agilent,

1.06 SUBMITTALS

- A. Submit testing data for each level of the building.
 1. An RF heat map of the building which indicates relative RF field strength for each frequency band of interest must be submitted.
 2. The map should indicate clearly the areas that have passed or failed based on the above parameters.
 3. Space planning surveys must be completed which identify where all active and passive components will be installed.
 4. If testing is done with the public safety/first responder equipment, the study of compliance needs to be signed by the agency as passing the DAQ level 3.0 test.
- B. If necessary, a layout of the antenna system that will be utilized to remedy any deficiencies in coverage. Include component specification sheets and detail drawings of the system.
 1. Floor plan drawings may include elevation detail names for each elevation view. Sheet title shall include site name, address, sheet number, floor plan number, and north arrow. Include site plan view of the subject buildings and surrounding property to clearly indicate the location and orientation of roof mounted outdoor antennas associated with the proposed system.
 2. Include a minimum of (1) building elevation depicting the location of any outdoor antennas associated with the proposed system. Include height of antenna centerline above building, orientation, and location of all external grounding connections.
 3. Include a detail plan view of all Telecommunications Spaces housing head-end and/or other consolidated equipment, showing the location of the rack(s) and/or enclosure(s) of the Emergency Responder Radio Antenna/Repeater System equipment.
 4. Include a separate plan view of each interior floor where indoor antenna systems are proposed. Include antenna numbers, coaxial cable routes, and the locations of any other system components including splitters, couplers, filters, amplifiers, etc. All components shall be named or labeled for reference in power budget calculations tables. Overlay approximated coverage radii indicating -95 dBm downlink (base to mobile) signal strength around each proposed indoor coverage antenna. Include results of any previous coverage testing per grid, if available.
 5. Include a minimum of one (1) detail elevation view(s) of all rack(s) and/or enclosure(s) housing the Emergency Responder Radio Antenna/Repeater System equipment. Identify each piece of equipment by brand, model number, and equipment type (e.g., Acme BA123 RF amplifier).
 6. Specify antenna grounding and surge protection in accordance with NEC Article 810.
 7. Specify the backup power source (Life Safety), and include calculations to ensure the backup power requirements as specified in this standard are met.

END OF SECTION

SECTION 27 00 00 - DIVISION 27 - COMMUNICATIONS INTRODUCTORY STATEMENT

PART 1 GENERAL

1.01 REQUIREMENTS

- A. All work included under this heading is subject to the Bidding Requirements, the Instructions to Bidders, the General Conditions, and/or the Division 1 General Requirements written for this entire Specification and shall apply to all work herein.
- B. In addition to conforming to the documents listed in Paragraph 1.01A above, the Work performed by the Division 27 Contractor shall conform to all provisions of Sections 27 00 00 through 27 99 99 as included and made part of this Specification. The Division 27 Contractor is to consider the word "Contractor" when used in these Sections to mean himself/herself.
- C. The Division 27 Contractor must read the entire Specifications of all divisions because he/she will be responsible for any and all Work described in other Sections where reference is made to Division 27 and/or Communications Contractor.

1.02 APPLICABLE SECTIONS

- A. Division 27 Contractor shall perform work described in the preceding paragraphs, and as it relates to Division 27 work.
- B. Where reference is made to the Division 26 Contractor in the above applicable Division 26 Specification Sections, it shall be construed to mean Division 27 Contractor.
- C. Refer to 26 05 20 Conductors and Grounding and 26 20 90 Building Services for Division 27 grounding and bonding requirements.

1.03 RESPONSIBILITY

- A. The Engineer's efforts under this Contract are aimed at designing a project that will be safe during construction and after full completion of the project. The Engineer has no expertise in, and takes no responsibility for, construction means and methods or job site safety during construction, which are exclusively the Contractor's responsibility. Processing and/or approving submittals made by the Contractor which may contain information related to construction methods or safety issues, or participation in meetings where such issues might be discussed must not be construed as voluntary assumption by the Engineer of any responsibility for safety procedures.
- B. If a conflict occurs between the Drawings and/or the Specifications, immediately call the conflict to the attention of the Architect at least ten (10) days before bids are submitted, so an addendum clarification may be issued. Conflicts not brought to the Architect's attention before bids are due, shall be priced by the Contractor to include the most expensive, highest quality and quantity of the conflicting items in question.

1.04 CONTRACTOR QUALIFICATIONS

- A. The Division 27 Contractor approved for this project shall meet the following qualifications and provide information as listed.
1. Must be a member of Building Industry Consulting Service International (BICSI) or have at least five (5) years' experience in Telecommunications Industry.
 2. A list of a minimum of five (5) projects over \$100,000 that the firm has completed along with contact names and phone numbers of the Owner's Representatives for those projects. At least three (3) of the completed facilities shall have been occupied and in full operation for at least one (1) year.
 3. Manufacturers shall have, within 150 miles, a service department of a duly authorized distributor who stocks standard parts on the premises.
 4. Refer to individual specification sections for additional qualifications.

END OF SECTION

SECTION 27 00 15 - SUBMITTALS

PART 1 GENERAL

1.01 DESCRIPTION

- A. Refer to the GENERAL CONDITIONS and Division 1 for general requirements.
- B. Materials and equipment installed in this work shall meet all the requirements of the Contract Documents and no materials or equipment shall be ordered until submittals are reviewed and approved by the Architect and Engineer.
- C. Submit complete catalog data or shop drawings for each manufactured item of equipment and all components to be used in the work, including specific performance data, material description, rating, capacity, working pressure, dimensional data, material gauge or thickness, wiring diagrams, brand name, catalog number, and general type.
- D. Catalog data for equipment reviewed by the Engineer shall not take precedence over the requirements of the Contract Documents. The review of the Engineer shall not relieve the Contractor from the responsibility for deviations from Drawings or Specifications, nor from the responsibility for providing proper clearance and coordination with other Trades.
- E. When submitted for review, all shop drawings shall bear the Contractor's signed certification that he/she has reviewed, checked, and approved the shop drawings, that they have been coordinated with the requirements of the project and with the provisions of the Contract Documents, and that he/she has verified all field measurements and construction criteria, materials, catalog numbers, and similar data. Annotations shall be in red ink.
- F. Each required Specification Section submittal shall be complete with all required information included in one PDF file. External web links are not permitted. Include a transmittal cover page indicating Specification Section name and number.
- G. Submittals shall be sent to shopdrawings@korda.com.

1.02 CONTRACTOR'S RESPONSIBILITIES

- A. Complete review of shop drawings, product data, and samples prior to submission.
- B. Determine and verify:
 - 1. Field Measurements
 - 2. Field Construction Criteria
 - 3. Catalog Numbers and Similar Data
 - 4. Conformance with Specifications
- C. Coordinate each submittal with requirements of the work and the Contract Documents.
- D. Include a letter in the front of the submittal of any deviations in the submittals from the requirements of the Contract Documents.
- E. Make submittals and resubmittals, if necessary, promptly in accordance with the approved schedule and in such sequence as to cause no delay in the work or in the work of any other Contractor, or the project as a whole.

- F. Make any corrections or changes in rejected submittals as required by the Architect and resubmit until approved.
- G. Begin no fabrication or work which requires submittals until approved submittals are returned.

1.03 INCORPORATION OF SUBMITTALS INTO RECORD AND INFORMATION MANUALS

- A. Refer to Section 27 00 20, "Record and Information Manuals."

1.04 CERTIFICATIONS

- A. Provide:
 - 1. Test Agency results verifying capacities, operating conditions and power requirements at design conditions
 - 2. Manufacturer's Statement of Compliance with Standards discussed in individual Specification Sections
 - 3. Equipment labels indicating Certification requirements
 - 4. Quality standard designations on each unit piece
 - 5. Typed verification that noted mixes, chemical compositions, and testing procedures were complied with
 - 6. Other Certifications listed in other Sections of the Specifications

1.05 REQUIRED SUBMITTAL INFORMATION

- A. Submittal Transmittal
 - 1. Provide the following information on the Transmittal Form for each submittal:
 - a. Project name and address.
 - b. Specification number, as listed for each submittal item required in Paragraph 1.05C below.
 - c. Item description, as listed for each submittal item required in Paragraph 1.05C below. Where equipment is identified by number or tag on the documents, same shall be indicated on the submittal.
 - d. Specification number and item description (b and c, above) for each submittal if more than one submittal is sent under one transmittal form.
 - e. Name, address and telephone number of Contractor.
 - f. Bid package number (if applicable).
 - 2. Submittal Transmittal Forms not properly identified with the above information will be returned (without review) to the Contractor.
- B. Refer to the following letter key:

KEY FOR REQUIRED SUBMITTALS:

- A. Shop Drawings and/or Layout Drawings
- B. Product Data Sheets
- C. Wiring Diagrams
- D. Installation, Operation, and Maintenance Instructions (Due at the end of project)
- E. Reports or Test results (Due at the end of project)

- C. Submit information on equipment items as listed below.

SECTION #	CONTRACT ITEM	SUBMITTALS REQUIRED
27 00 20	RECORD AND INFORMATION MANUALS	A, B, C, D
27 10 00	STRUCTURED CABLING SYSTEM	A, B, E
27 41 05	VIDEO MONITOR DISPLAY SYSTEM	B, C, D, E
27 51 31	LOCAL SOUND SYSTEM	B, C, D, E

- D. After approval, one (1) copy shall be returned to the Contractor. Contractor shall make prints of the approved transparencies and reproductions of all other shop drawing information as necessary for his/her use and for inclusion in the Record and Information Manuals.

END OF SECTION

SECTION 27 00 20 - RECORD AND INFORMATION MANUALS

PART 1 GENERAL

1.01 RECORD DRAWINGS

- A. Refer to Division 1 for general requirements as well as for specific information regarding Record (As-Built) Drawings. All drawings shall be provided in electronic PDF format.

1.02 OPERATION AND MAINTENANCE MANUALS

- A. Refer to Division 1 for general requirements and for specific information regarding Operation and Maintenance Manuals, including required format(s) (paper and/or electronic) and quantity. If no such requirements are listed in Division 1, provide in electronic format. Submit one (1) copy of draft manual to the Architect for review and approval thirty (30) days before final inspection is due. After approval, submit three (3) approved manuals to the Owner and obtain receipt. (See Section 26 00 99, "Requirements for Contract Completion.")
- B. Paper Copy Manuals shall be loose leaf, three-ring, heavy-duty hard-cover binders. Material shall be typewritten or printed and be fully legible. Each section shall be divided by labeled tabs.
- C. Electronic Copy Manuals shall be PDF file format. Individual documents shall have filenames corresponding to specification sections and system names. Each document shall have bookmarks corresponding to the systems, subsystems, and equipment names. Use electronic files prepared by manufacturers where available.
- D. The following items, together with any other necessary pertinent data, shall be included in each Manual:
 - 1. Each manual shall be labeled on front cover with project name, Contract, Contractor's name, Architect, Engineer, and date of project completion.
 - 2. Manufacturers' names, nearest Factory Representative, and model and serial numbers of components of systems
 - 3. Operating instructions, start-up and shutdown procedures
 - 4. Maintenance instructions
 - 5. Routine and 24 hour emergency service/repair information:
 - a. Name, address, and telephone number of servicing agency
 - b. Names of personnel to be contacted for service arrangements
 - 6. Parts list with numbers of replaceable items, including sources of supply
 - 7. Manufacturers' literature describing each piece of equipment
 - 8. One (1) approved copy of each submittal
 - 9. Written warranties
 - 10. Certificate of Material Receipt and Certificate of System Completion
 - 11. Record (As-Built) Drawings
 - 12. IP and MAC address identified for each item required to have an address
 - 13. Certificate of Final Inspection signed by Building Authority Having Jurisdiction
 - 14. Test results
 - 15. Video recordings of all equipment demonstrations and training sessions

END OF SECTION

SECTION 27 10 00 - STRUCTURED CABLING

PART 1 GENERAL

1.01 DESCRIPTION

- A. This document describes the product and execution requirements related to furnishing and installing the Structured Cabling System as shown on the Drawings and specified herein.

1.02 SCOPE OF WORK

- A. The Structured Cabling Contractor (SCC) shall provide a complete Structured Cabling System (SCS) as defined in this section.
- B. As described elsewhere in these Documents the system consists of fiber optic and copper cabling, and related hardware. In addition to the basic cable plant requirements, the testing and identification requirements are also defined. Finally, racks, enclosures and other related hardware are indicated herein.
- C. The installation shall be of an "Open System," using standard media and layout, standard connections and interfaces. The Contractor shall adhere to this Specification, local and national codes and provide quality workmanship.
- D. This section includes:
 - 1. Main Telecommunications Room (MTR)
 - 2. Telecommunications Room (TR)
 - 3. Racks, Enclosures and Cable management
 - 4. Ladder Rack
 - 5. Rack mounted surge suppressor
 - 6. Lightning Protector
 - 7. Backbone cabling
 - 8. Horizontal cabling
 - 9. Consolidation Points
 - 10. MTR and TR connections
 - a. Patch Panels
 - b. Fiber enclosures
 - 11. Work Area outlets
 - a. Faceplates
 - b. Connectors (jacks)
 - 12. Work Area Extensions to Device
 - 13. Hangers and Supports
- E. The components used on this project for voice, data, and CATV shall be as identified in Part 2 of this Section.
- F. Unless noted otherwise on the Drawings, for all 4 pair Category cable, this project shall use T568B termination for eight (8) position jack pair assignments as specified per the ANSI/TIA 568-C wiring standard. For fiber, follow ANSI/TIA 568-C.3, Optical Fiber Cabling Components Standard, and its published addenda.

- G. All continuous pathways (i.e., conduit, cable tray, raceway, etc.) required to support the cabling shall be provided by the Electrical Contractor under Division 26 unless indicated otherwise in the Contract Documents.
 - 1. All non-continuous or non-rigid pathways (i.e., J-hooks, inner-duct, etc.) required to support the cabling shall be provided by the SCC under the Structured Cabling System, unless indicated otherwise in the Contract Documents.
 - 2. All ladder rack, cable tray, and related pathway hardware built into Telecommunications Spaces shall be provided by the SCC.
- H. The SCC shall be responsible for providing the racks and enclosures as required and specified herein.
- I. The SCC shall test and label the entire installation as specified and required by the codes and standards.
- J. The SCC shall be responsible for providing the hangers and support system specified herein and shown on the Drawings.
- K. Final sizing and location of J-hooks, hangers, and supports shall be the responsibility of the Contractor. However, NO increases to the bid price and/or the schedule extension shall be allowed due to equipment alterations.
- L. For new installations, J-hooks fill capacity shall not exceed 70% of its rated cable fill capacity (i.e., if J-bracket is rated for 100 cables, no more than 70 shall be installed).
- M. J-hooks are intended for voice, data, video, audio, and security cables only. They are intended for cable routing in areas of less than 100 Category 6 cables. All other low voltage cabling systems, such as building controls, shall have cabling run-ins separate raceway system.
- N. All hangers and support material shall be galvanized or stainless steel, rust free material.
- O. The Telecommunications Contractor shall ensure that the General Contractor and Painting Contractor acknowledge that the painting or over spray of any single or group of 4 pair horizontal telecommunications Category cable is not allowed. Any painted or over sprayed cable(s) shall be completely removed and replaced at the Painting Contractor's expense. No in-line connectors, splices, taps or other repairs will be permitted. Painted cable will not be covered as part of an extended warranty. Painted cable obscures the print legend and can alter the cable's mechanical properties and fire rating. Painted cable compromises its integrity and/or performance. It may act as an accelerant or create an additional smoke hazard in the event of a fire and as such this is considered a life safety issue. Paint contamination and/or removing paint from the cable with a solvent can affect the cable's durability and its electrical characteristics.

1.03 QUALIFICATIONS

- A. The SCC must meet the following requirements to be approved for this project. He/she shall meet the following qualifications and provide the information, as listed, in the submittal package:
 - 1. Must be a member of Building Industry Consulting Service International (BICSI) or Engineer approved, other Telecommunications Organization, and shall have at least five (5) years' experience installing Telecommunications Cabling and Equipment.

2. Supply a list of a minimum of five (5) projects over \$100,000 that the firm has completed along with contact names and phone numbers of the Owners' Representatives for those projects. At least three (3) of the completed facilities shall have been occupied and in full operation for at least one (1) year.
 3. The SCC shall be a certified installer for the connectivity and cabling solution specified for this project and maintain that status with the warranting manufacturer, including all training requirements, for the duration of the cable infrastructure project.
 4. The SCC shall have, as a direct employee, a minimum of one (1) RCDD on staff. The RCDD must be a full-time employee of the company and must be listed with the company on the BICSI Credential Holder website. This individual shall review all submittals, RFIs, change order proposals, as-built documents, and shall provide system engineering support and oversight of all field work to ensure system installation is fully compliant with all requirements of ANSI/TIA-568-C, ANSI/TIA-569-D, and all associated TSBs, ANSI/TIA-606-B, labeling, and ANSI/TIA-607, bonding and grounding, including all addenda.
 5. The SCC's RCDD shall stamp all test results included in the Record and Information Manual and the final (field marked) As-Built Drawings, as being correct and accurate, that are included in the Record and Information Manual.
 6. It is the intent of this contract for the Contractor to provide sole responsibility for material, labor, and service for the communication cabling system. The Contractor shall, at a minimum, staff the project with BICSI certified installers for project foremen and crew leader positions.
 7. The SCC must own or have a current lease agreement for equipment to test up to Category 6a and fiber optic cable. He/she shall supply proof as required above in the submittal package, including latest calibration date.
- B. At the time of bid form submission, the SCC shall submit the following information:
1. The SCC's manufacturer certifications for:
 - a. Twisted pair cabling
 - b. Fiber optic cabling
 - c. Connectivity
 2. The RCDD's BICSI certification. Refer to SCC's Qualifications below.
 3. A listing of the like projects within the last three (3) years. Refer to SCC's Qualifications below.
- C. During the bid review, the SCC may be asked to provide any/or all of the following:
1. A listing of the probable team members
 2. BICSI and manufacturer certifications for the installation of the Structured Cable Plant.
 3. Certifications for the installation for any firestopping required under the scope of the Structured Cable Plant installation.
- D. Any/all items listed in paragraph 1.03 subparagraph B.1 or B.2, can and will be checked for authenticity and accuracy. The Owner reserves the right to reject any unauthorized or inaccurate submissions.
- E. Should the SCC either fail or refuse to provide any of the items listed and/or requested in paragraph 1.03 subparagraph B.1 or B.2, the Owner reserves the right to determine the SCC as being not fully responsive and as such discard the bid in its entirety.

1.04 SUBMITTALS

- A. Product Data Sheets
1. All products
 2. Copies of all certifications

- B. Shop Drawings
 - 1. The SCC shall submit the following shop drawings:
 - a. A detailed riser diagram demonstrating the SCC's understanding of the backbone cabling.
 - b. Drawings of any floor boxes with details of the various internal faceplates and their respective contents.
 - c. Drawings of any through floor fittings with details of their contents.
 - d. Layout drawings for cable tray and cable runway (1/16" scale minimum) based on trade coordination efforts indicating anticipated routings based on the coordination among the various trades.

PART 2 PRODUCTS

2.01 MAIN TELECOMMUNICATIONS ROOM/DEMARC (MTR)

- A. The SCC shall provide plywood backboard as shown on the Drawings. If the Drawings do not indicate where or how much plywood is to be installed, Contractor shall provide, as a minimum, two (2) walls covered by 3/4 inch x 4 feet x 8 feet fire retardant plywood, painted industrial gray with two (2) coats of fire retardant paint. Plywood shall be AC grade or better and void-free with Grade A surface exposed. To reduce warping, plywood shall be kiln-dried to a maximum moisture content of 15%.
 - 1. Fire retardant plywood shall be securely fastened to wall such that it can and will support equipment to be mounted. Additionally, it shall be mounted such that the 8 feet is vertical. Unless otherwise noted, bottom of plywood shall be mounted 8 inches AFF.
 - 2. Contractor shall cover with masking tape the "Fire Retardant" stamp on the plywood, before painting, and remove tape after painting, so that the inspector can still see the original "Fire Retardant" stamp on the plywood.
 - 3. Cut out plywood around all wiring devices.
- B. The SCC shall provide all equipment required and/or shown on the Drawings to make MTR a safe and usable room for the Structured Cabling System.
- C. For fiber optic cable entering from outside or from another TR coil, provide 30 feet of slack on re-closeable storage ring before routing cable to rack for termination in rack mounted fiber panel using LC connectors (unless otherwise noted).
- D. Terminate copper station cable coming from TRs or work areas in a standard 19 inch data rack, rack mounted patch panel with 110 type punch down terminations located close to incoming protector unit.
- E. Install racks, cable management, enclosures, patch panels, ladder racks, cables, and other equipment required in MTR as shown on Drawings. If no equipment location is indicated, coordinate rack and equipment location with Owner before installing equipment.
- F. Provide MTR with ladder racking or wire mesh cable tray as shown on Drawings. Fasten ladder racking or cable tray to data racks.
- G. Provide grounding and bonding as specified in Section 26 20 90, "Building Services"
- H. Provide "D" rings for cable routing support on backboards, for feeding cables up or down from ladder rack and/or floor.

2.02 TELECOMMUNICATIONS ROOM (TR)

- A. The SCC shall provide plywood backboard as shown on the Drawings. If the Drawings do not indicate where or how much plywood is to be installed, Contractor shall provide, as a minimum, each TR with at least two (2) walls covered by 3/4 inch x 4 feet x 8 feet fire retardant plywood, painted industrial gray with two (2) coats of fire retardant paint. Plywood shall be AC grade or better and void-free with Grade A surface exposed. To reduce warping, plywood shall be kiln-dried to a maximum moisture content of 15%.
 - 1. Fire retardant plywood shall be securely fastened to wall such that it can and will support equipment to be mounted. Additionally, it shall be mounted such that the 8 feet is vertical. Unless otherwise noted, bottom of plywood shall be mounted 8 inches AFF.
 - 2. Contractor shall cover with masking tape the "Fire Retardant" stamp on the plywood, before painting, and remove tape after painting so that the Inspector can still see the original "Fire Retardant" stamp on the plywood.
 - 3. Cut out plywood around all wiring devices.
- B. The SCC shall provide all equipment shown on the Drawings or as required to make TRs safe and usable for the structured cabling system.
- C. For fiber optic cable entering from another TR coil, provide 30 feet of slack on re-closeable storage ring before routing cable to rack for termination in rack mounted fiber panel using LC connectors.
- D. For copper station cable, terminate in a rack mounted patch panel with 110 type punch down termination.
- E. For audio/video cable, terminate in the audio/video rack as required by the equipment using the proper connectors.
- F. Install racks, cable management, enclosures, patch panels, ladder racks, cables, and other equipment required in TR as shown on Drawings. If no location is indicated, coordinate with Owner before installing equipment.
- G. Provide TR ladder racking or wire mesh cable tray as shown on Drawings. Fasten to data racks.
- H. Provide grounding and bonding as specified in Section 26 20 90, "Building Services"
- I. Provide "D" rings for cable routing support on backboards, for feeding cables up or down from ladder rack and/or floor.

2.03 RACKS, ENCLOSURES, AND CABLE MANAGEMENT

- A. Wall Mounted Equipment Swing-Out Cabinet nominal 19 inches
 - 1. Finish shall be flat black powder coat, dimensions to be 46" tall x 26" wide x 26" deep.
 - 2. Wall mounted data rack, 26RMU
 - 3. Perforated front door.
 - 4. Reversible cabinet for left and right-hand swing-out.
 - 5. EIA/ECA-310-E compliant, double sided universal mounting holes #12-24, supply minimum of fifty (50) #12-24 mounting screws
 - 6. Approved manufacturer Ortronics SWM26RUPD-26-26
 - a. Equivalents by Belden, Chatsworth, Hoffman, and Panduit

- B. Horizontal Cable Management
 - 1. Units shall be 1U to 3U construction.
 - 2. Units shall be single sided.
 - 3. Units shall have covers that have a dual hinge technology.
 - 4. Access into and out of the top and bottom of the Management shall be finger type construction.
 - 5. Approved manufacturers:
 - a. Belden
 - b. Chatsworth
 - c. Great Lakes
 - d. Ortronics
 - e. Panduit
 - 6. Basis of Design – 1U horizontal vertical cable manager: Chatsworth #30139-719
 - 7. Basis of Design – 2U horizontal vertical cable manager: Chatsworth #30130-719
 - 8. Basis of Design – 3U horizontal vertical cable manager: Chatsworth #30131-719

2.04 LADDER RACK

- A. Ladder rack shall be manufactured from tubular steel. Stringers (side rails) shall be 1.5 inches deep. Maximum fill is equivalent to TIA recommended maximum fill of 6 inches deep. Provide accessory cable retaining posts if cable fill height exceeds 2 inches. Where cable retaining posts are used, they shall be 8 inches high and shall attach to the side stringer of the ladder rack with included hardware. The top of the cable retaining posts shall be fitted with a rubberized end cap to protect cables.
- B. Unless otherwise noted on the Drawings, ladder rack width shall be 18 inches with cross member (rung) spacing on 9 inch centers.
- C. All cross members shall be welded into position for maximum strength and electrical continuity of elements. No cross members shall protrude below side members that would interfere with supporting structures.
- D. All straight sections shall be provided in standard 10 foot nominal sections.
- E. Provide a method of splicing ladder rack sections and fabricated turns together end-to-end or side-to-end to form a continuous pathway.
- F. Vertical-to-horizontal and horizontal-to-vertical 90-degree turns shall be provided as required
- G. Ladder rack supports shall be of the trapeze type. Supports shall be sized to match the width of the ladder rack that is supported. Support design shall allow the support to be placed under the ladder rack at any point mid-span, but not under a ladder rack splice.
- H. All ladder rack elbows, tees, and cross fittings shall be furnished in a radius of 12, 24, or 36 inches in 30, 45, 60, or 90 degrees of arc as necessary to meet the National Electrical Code and BICSI bending radius limitations of cables to be installed in the trays. Using straight runs with radius corner brackets is also acceptable.
- I. Dropouts shall be aluminum sheets with round radius attached to either side stringer or cross member to permit cable exit out of bottom of cable tray. Where cable exits or enters the side of overhead ladder rack to access a rack, frame, cabinet or wall-mounted rack, cabinet or termination field, a radius drop shall be used to guide the cable.

- J. End caps shall be provided to cover the ends of the ladder rack. End caps shall be manufactured from a black fire-retardant rubberized material.
- K. Cable straps used for attaching cable bundles to the ladder rack cross members must be reusable with a hook and loop-style closure, at least 3/4 inch wide, and sized for cable bundles that are 2 inches, 3 inches, or 4 inches in diameter.
- L. Unless otherwise noted, finish on all metal components shall be black epoxy-polyester hybrid powder coat.
- M. Separate different cable media types within the ladder rack pathway. Treat each type of cable media separately when determining cable fill limits.
- N. Provide touch-up paint color-matched to the finish on the component and correct any minor cosmetic damage (chips, small scratches, etc.) resulting from normal handling during the installation process prior to delivery to the Owner. If a component is cosmetically damaged to the extent that correction in the field is obvious against the factory finish, replaced with a new component finished from the factory. If a component is physically damaged due to mishandling or modification during the installation process, it shall not be used as part of the ladder rack system.
- O. Approved manufacturer: Chatsworth Universal Cable Runway
 - 1. Equivalents by Belden Runway Products, Great Lakes, Middle Atlantic, Panduit, and Snake Tray.

2.05 RACK MOUNTED SURGE SUPPRESSOR

- A. For all wall-mounted enclosures, provide horizontal rack mounted power strip with surge protection and six NEMA 5-20R outlets. Basis of design is CPI 12816-707 with equivalents by APC, Belden, Geist, Panduit, or Tripp-Lite.

2.06 LIGHTNING PROTECTOR

- A. Provide one Telecom Building Entrance Terminal, sized for the number of pairs entering the building, at the demark to cover incoming and outgoing connections.
 - 1. Units shall utilize 110 blocks for both input and output.
 - 2. Units shall comply with UL 497.
 - 3. Units shall be powder epoxy coated.
 - 4. Units shall utilize a five pin socket for devices.
- B. All outdoor devices shall have surge protection at the equipment rack (close to the device being protected). Sized for the number of pairs and expected voltage.
- C. Acceptable Manufacturer and Model
 - 1. Basis of Design: Detek series modules.
 - 2. Equivalent by Circa 1880ECA1 series (25, 50, 100), with C3B1S solid state protector modules, Siemon, Panduit, Porta Systems or Engineer approved equivalent.

2.07 BACKBONE CABLING

- A. The SCC shall provide all backbone cabling system as shown on the Drawings and as required to make a complete installation (both copper and fiber).

- B. Outside Plant, Copper Cable
 - 1. Approved cable manufacturers for PE 89 type, 50/100/300 multi-pair cable:
 - a. Superior Essex
 - b. General
 - c. Omni Cable
 - 2. Approved cable manufacturers for Category 5e, UTP, 25 pair:
 - a. Belden
 - b. Mohawk
 - c. Superior Essex
- C. Outside Plant, Fiber Optical Cable shall be indoor/outdoor or outside plant "tight buffer" type cable. All fiber not installed in conduit must be armored or installed in inner duct.
 - 1. Strand count shall be as shown on the Drawings.
 - 2. Cable shall be single-mode and/or minimum OM3 50/125-micron multimode cable unless otherwise shown on the Drawings.
 - 3. Fiber must be protected from moisture with a moisture resistant jacket and a filling of water blocking material.
 - 4. Approved cable manufacturers:
 - a. Belden
 - b. BerkTek
 - c. CommScope
 - d. Corning
 - e. Mohawk
 - f. Panduit
 - g. Superior Essex
 - h. TCS
- D. Inside Plant, Copper Cable
 - 1. Approved cable manufacturers for 25/50/100 multi-pair Category 3 copper plenum cable:
 - a. Belden
 - b. BerkTek
 - c. CommScope
 - d. Mohawk
 - e. Superior Essex
 - 2. Approved cable manufacturers for 25 PR Category 5e, UTP plenum cable:
 - a. Belden
 - b. BerkTek
 - c. CommScope
 - d. Mohawk
 - e. Superior Essex
- E. Inside Plant, fiber optical cable shall be tight buffer type plenum rated armored cable.
 - 1. Strand count shall be as shown on the Drawings.
 - 2. Cable shall be single-mode and/or OM3 50/125-micron multimode cable as shown on the Drawings.
 - 3. Approved cable manufacturers:
 - a. Belden
 - b. BerkTek
 - c. CommScope
 - d. Corning
 - e. Mohawk
 - f. Panduit
 - g. Superior Essex
 - h. TCS

2.08 HORIZONTAL CABLING

- A. Copper Station Cabling from the TR to the work area jack shall be:
 - 1. Category 6, UTP, 4 pair, plenum rated approved manufacturers:
 - a. Belden 3613
 - b. BerkTek LANmark 1000
 - c. Mohawk AdvanceNet
 - d. Panduit PUP6004
 - e. Superior Essex DataGain Cat 6+
 - 2. Category 6a, UTP, 4 pair, plenum rated approved manufacturers:
 - a. Belden 10GXS13
 - b. BerkTek LANmark 10G2
 - c. Mohawk GigaLAN 10 Reduced Diameter
 - d. Panduit PUP6AV04
 - e. Superior Essex 10GainXP
 - 3. Category 6, UTP, 4 pair, OSP rated approved manufacturers:
 - a. Belden OSP6U 0101000
 - b. BerkTek LANmark 6 OSP UTP
 - c. Mohawk LAN-Trak 6 OSP M57622
 - d. Panduit PUO6C04
 - e. Superior Essex CMR/CMX Cat 6
- B. Fiber optical station cabling from the TR shall be terminated on LC connectors mounted in fiber duplex jack modules.
- C. Cabling for wireless access point shall be two Category 6a cables with a 25 foot figure 8 service loop for each AP (unless otherwise noted).
- D. Cabling for CCTV indoor Cameras shall be one Category 6 cable with a 10 foot figure 8 service loop for each camera (unless otherwise noted). Contractor may use a direct connect plug for the cameras, but the contractor must use a "modified single connector permanent link" test to test the cable run. The manufacturer must supply a warranty for the direct connect link. Examples: Belden REVConnect RJ45 Plug, Legrand High Performance Cat 6 RJ45 Modular Plug, Leviton Atlas X1 plus patch cord, and Panduit mini-com direct attachment plug FP6X88MTG.
- E. Program speaker cable shall be 16 AWG UTP single pair cable as shown on Drawings.
 - 1. Approved cable manufacturers:
 - a. Belden
 - b. CommScope
 - c. West Penn
 - d. General
- F. Cabling for HDBaseT video extension (or similar proprietary solutions, such as Extron DTP, Crestron DigitalMedia, etc.) applications shall be one Category 6A cable with a discontinuous shield (unless otherwise noted). Cable shall be certified by the HDBaseT alliance for HDBaseT applications. Contractor may use a direct connect plug for HDBaseT applications, but the contractor must use a "modified single connector permanent link" test to test the cable run. The manufacturer must supply a warranty for the direct connect link. Examples: Belden REVConnect RJ45 Plug, Legrand High Performance Cat 6A RJ45 Modular Plug, and Panduit mini-com direct attachment plug FP6X88MTG.
 - 1. Approved cable manufacturers:
 - a. Belden
 - b. Berktek

- c. Panduit
- d. Superior Essex

2.09 MTR AND TR CONNECTIONS

- A. Patch panels for Category 6 cables shall be:
 - 1. Belden Category 6 KeyConnect 6+
 - 2. Leviton eXtreme 6+
 - 3. Ortronics Category 6
 - 4. Panduit Cat 6 PanNet
- B. Patch panel for Category 6a cables shall be:
 - 1. Belden Category 6A KeyConnect 10GX
 - 2. Leviton eXtreme 6a
 - 3. Ortronics Category 6a
 - 4. Panduit Cat 6 PanNet
- C. Patch panel shall be standard or modular type punchdown patch panels.
- D. Fiber Patch Panels shall be LC connectors mounted in fiber duplex jack modules.
 - 1. Belden Fiber - FX UHD
 - 2. Leviton Opt-X Ultra
 - 3. Ortronics 1U Fiber Patch/Splice
 - 4. Panduit OptiCom
 - 5. TCS 1U Fiber Patch/Splice

2.10 CONSOLIDATION POINTS

- A. Wiring blocks for consolidation points shall be 110-style by Belden, Leviton, Ortronics, or Panduit.
- B. Passive, plenum-rated 2' x 2' telecommunications enclosures for consolidation points shall be Leviton Z1000-PC2 or equivalents by Belden, Ortronics, or Panduit.

2.11 WORK AREA OUTLETS

- A. Work area faceplates for flush devices in interior partitions shall be stainless steel.
- B. Work area faceplates for flush devices on concrete block walls shall match others but be "Jumbo" plates.
- C. Work area jacks for Category 6 cables shall be:
 - 1. Belden Category 6+ KeyConnect 6+
 - 2. Leviton eXtreme 6+
 - 3. Ortronics Category 6
 - 4. Panduit CJ688TGxx

2.12 WORK AREA EXTENSIONS TO DEVICE

- A. Patch Cords shall be manufactured and supplied by the manufacturer of the connectivity and shall be rated for the same performance specifications as the cabling and connectivity being utilized. These cords shall be small diameter type patch cords, 24 to 28 AWG stranded conductors.

- B. Unless otherwise indicated on the Drawings, the Contractor shall provide two cables for each work area outlet data jack (one for work area outlet and one for TR) and one cable for each wall phone jack (for TR only). Of the cables provided, the Contractor shall supply 50% of the cables as 3 feet (1 meter) and 50% as 10 feet (3 meters). Refer to the Technology Drawings for any specific quantities and lengths that may override these criteria. Category 6a patch cords shall be used for category 6a connectivity.
- C. Unless otherwise noted, mounting and installing of work area equipment such as computers, phones printers, etc. are not part of the SCC's scope of work under this Specification.

2.13 HANGERS AND SUPPORTS

- A. J-Hooks
 - 1. J-hooks shall be at least 1 inch hook size, minimum.
 - 2. J-hooks shall not be over 4 inch hook size (for locations requiring 100 4-PR Category 6 cables or more, use basket tray).
 - 3. J-hooks shall be manufactured from Spring Steel. Securable to wall, beam, threaded rod, unistrut, or pipe.
 - 4. May utilize multi-tier configuration.
 - 5. J-hooks shall have no sharp edges.
 - 6. Approved J-Hook Manufacturers:
 - a. Cooper B-Line J-hook
 - b. ERICO, type Cable Cat 21 and 32
 - c. Mag Daddy
 - d. Panduit J-Pro Series
 - e. Or Engineer approved equivalent
- B. Threaded Rods
 - 1. Threaded rod is to be attached to building steel in a permanent manner. Minimum size of threaded rod shall be 3/8.
 - 2. Threaded rods are to be used for J-hook support where required.
 - 3. When used for wire basket or cable tray support, use threaded rods with a hanger trapeze kit or unistrut to form a trapeze type support for the wire basket or cable tray.

PART 3 EXECUTION

3.01 DOCUMENTS

- A. Prepare and supply documents required. See "TESTING" below.

3.02 BACKBONE CABLING INSTALLATION

- A. The SCC shall provide labor, supervision, and materials as required for a complete installation of the backbone cabling system which includes, but is not limited to, the cabling to and from the MTR and to the TR, pulling, supporting, terminating, labeling and testing.
- B. Vertical cable runs shall be supported by split cable grip every 20 vertical feet.

3.03 MTR INSTALLATION

- A. The SCC shall provide labor, supervision, and materials as required for a complete installation of the MTR and cabling.

- B. The SCC shall route incoming cables to proper location by means of ladder racking, cable tray, and/or backboard. Cable shall be routed neatly (vertical/horizontal) with some slack before termination at the proper location.

3.04 TR INSTALLATION

- A. The SCC shall provide labor, supervision, and materials as required for a complete installation of the TR cabling and cabling going to and from the TR.
- B. The SCC shall route incoming cables to proper location by means of ladder racking, cable tray, and/or backboard. Cable shall be routed neatly (vertical/horizontal) with some slack before termination at the proper location.

3.05 HORIZONTAL CABLING INSTALLATION

- A. The SCC shall provide labor, supervision, and materials as required for a complete installation of the horizontal cabling system that includes, but is not limited to, cabling from the TR to the work area, pulling, supporting, terminating, labeling, and testing.
- B. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.
- C. Where transition points or consolidation points are allowed, they shall be located in accessible locations and housed in an enclosure intended and suitable for the purpose.
- D. Each consolidation point (CP) shall serve a maximum of 12 work areas and shall be installed with a minimum of 25% spare terminations. No more than one CP shall be placed in each permanent link. CPs shall be located in fully accessible and permanent locations, a minimum of 50 feet from the TR or MTR.
- E. When CPs are installed in a suspended ceiling or access floor space, the ceiling or floor tile locations should be clearly and permanently marked and identified as containing a CP.
- F. Exception to ANSI/TIA 568-C distance limitations for horizontal category 6 cables. Extending Ethernet and POE Ethernet cabling distances beyond the 100 meter limit is permitted using Ethernet extenders for devices such as CCTV cameras, wireless access points, and IP blue light telephones. The cable must be tested to the extender manufacturer's specifications. Only use this exception where noted on the drawings.

3.06 WORK AREA INSTALLATION

- A. The SCC shall provide labor, supervision, and materials as required for a complete installation of work area that includes, but is not limited to, terminating cable, placing the jacks and modules, faceplates, labeling and testing.
- B. Upon completion of the project, the SCC shall clean work area and leave ready for move-in. He/she shall remove all marks, fingerprints, trash, and other debris from area.

3.07 HANGERS AND SUPPORTS INSTALLATION

- A. Hangers and supports for ladder rack and cable tray shall be supported every 5 feet or less in accordance with ANSI/TIA-569-D. Ladder rack and cable tray shall be supported within 2 feet of every splice and within 2 feet on both/all sides of every intersection. Support ladder rack and cable tray within 2 feet on both sides of every change in elevation. Support ladder rack every 2 feet when attached vertically to a wall.
- B. Threaded rod for support of hooks and/or trays shall be permanently fastened to structural steel.
- C. J-hooks shall be securely fastened to wall, steel, or other structural element and spacing shall vary between 4 foot and 5 foot on center.
- D. Contractor should install cable to be independently supported by approved cable tray or hanger and support products specified in this section. Avoid draping cable to be in contact and supported by other trades' products such as ductwork, sprinkler piping, plumbing, ceiling tile, etc.

3.08 WORK

- A. The SCC shall furnish all materials, labor, and supervision required to install and put into service the structured cabling system specified and shown on the Drawings.
- B. The SCC shall be aware that they must coordinate their work with other trades and lack of access to the job site does not relieve them of the responsibility to complete the work as scheduled.
- C. The SCC shall furnish sufficient manpower and resources to finish the project when scheduled for completion. If required, the SCC will work their crew overtime to meet the completion schedule with no additional compensation.
- D. All work shall be done in a professional manner; equipment installed vertical and horizontal; cables pulled neat and aligned, but allowing slack; cables bundled, but no tie wraps shall be used; use hook and loop straps loosely, do not tighten cable bundle.
- E. All conduits pull boxes, junction boxes, AP enclosures, cables, jacks, modules and other devices shall be labeled.

3.09 CABLE ROUTING

- A. The SCC shall avoid electromagnetic interference (EMI) by routing all structured cabling a minimum of:
 - 1. 4 feet from 480 volt motors and transformers
 - 2. 12 inches from electrical power distribution cables
 - 3. 6 inches from fluorescent lighting
- B. Horizontal cable shall not exceed 90 meters.
- C. Conduits shall have no more than an equivalent of two (2) 90 degree bends allowed in any single run between junction boxes.

- D. Cables in open or non-continuous pathways shall be routed such that the following bending radius limitations are not exceeded:
 - 1. 4-pair UTP – minimum 4 times the overall cable diameter
 - 2. 4-pair STP – minimum 8 times the overall cable diameter
 - 3. Fiber Optic Cabling – minimum 20 times the overall cable diameter
 - 4. Other Structured Cabling – refer to latest ANSI/TIA 568 Standard
- E. Whenever possible, cables shall be routed from technology room into corridor and follow the corridor before branching out to the work area outlet location.

3.10 TESTING

- A. The SCC shall provide a copy of the unaltered certification test reports to the Engineer in both hardcopy and electronic format. The Contractor shall also provide a copy of the associated Cable Tester's Database Management Software with unedited soft copy.
- B. Upon completion of the balanced twisted-pair cable installation, the SCC shall perform copper cable certification tests on the complete channel for every cable, included but not limited to:
 - 1. Wire map
 - 2. Length
 - 3. Attenuation
 - 4. Near End Cross Talk (NEXT)
 - 5. Attenuation to Crosstalk Ratio (ACR-F)
 - 6. Propagation Delay and Delay Skew
 - 7. Return Loss
 - 8. Power Sum Near End Cross Talk (PSNEXT)
 - 9. Power Sum Equal Level Far End Cross Talk (PSELFEXT)
 - 10. Insertion Loss
- C. Test shall be performed to published standards, including but not limited to, the latest revisions of ANSI/TIA 568-C, ISO/IEC 11802 and other applicable standards at the time of installation.
- D. All UTP/ScTP field testers shall be factory calibrated each calendar year by the field test equipment manufacturer as stipulated by the manuals provided with the field test unit. The calibration certificate shall be provided to the Engineer for review prior to the start of testing.
- E. All Category 6 permanent links are qualified for linear transmission performance up to 250 MHz and all Category 6a permanent links are qualified for linear transmission performance up to 500 MHz to ensure that high frequency voltage phase and magnitude contributions do not prove cumulative or adversely affect channel performance.
- F. Upon completion of the fiber optic cable installation, the SCC shall perform optical time domain reflectometer (OTDR) testing and optical loss testing with a light source power meter on every cable.
- G. In addition to any specific tests mentioned here, the SCC shall perform all required testing and documentation to obtain a fully certified installation from the manufacturer.
- H. As may be required for extended applications warranties by the manufacturer, the manufacturer shall provide site inspection services of the installation in completed and/or in progress. The SCC shall make all necessary arrangements for such site visits.

- I. Upon completion of all installation, termination and testing, the SCC shall review the entire installation with the Engineer and, at the discretion of the Owner, the Owner's authorized representative. At the time of this review, the Contractor shall present the hard copies of all unadulterated test results. The Engineer and Owner will review these test results, assess the installation, and return a written letter of acceptance to the Contractor for the Structured Cabling System.

3.11 WARRANTY

- A. The SCC shall provide a minimum twenty (20) year extended Product and Applications Warranty on parts and labor from the Connectivity Manufacturers (certified Contractor Program).

END OF SECTION

SECTION 27 41 05 - VIDEO MONITOR DISPLAY SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION

- A. The Contractor shall comply with Section 27 00 00, "Division 27 - Communications Introductory Statement" of Division 27 Specifications.
- B. This document describes the minimum Monitor Display requirements. The Contractor shall provide the same brand of television units throughout this project regardless of picture size where possible.

1.02 SCOPE OF WORK

- A. Provide a Display System as shown on the Drawings and as specified herein. Provide all accessories and equipment necessary for a complete operational system.
- B. The Contractor is hereby, specifically, made aware that this work is to be completed near the end of the project. Installing the Display System ahead of schedule will subject them to the possibility of damage. It shall be the Contractor's responsibility to see that the Displays are protected and in undamaged condition when turned over to the Owner.
- C. No additional compensation shall be considered or granted for "Red Overnight or Express" deliveries or for "Over/Premium Time" pay to meet the required completion schedule.
- D. The Contractor shall provide a satisfactory wall mounting unit rated for the Monitor Display brand and weight.
- E. The Contractor shall supply knowledgeable staff for installing, testing, programming, and adjusting the Monitor Display such that they have the picture quality/color intended and to the satisfaction of the Owner.
- F. The Contractor shall supply one submittal package with all information required.

1.03 QUALITY ASSURANCE

- A. All equipment shall be new, UL listed, in proper operating condition and labeled in accordance with applicable NEMA and ANSI Standards. Demo equipment will not be acceptable.
- B. Audio System shall meet industry standards and professional practice.
- C. Work in this section shall be performed by a Contractor who has at least three (3) years of verifiable direct experience with the devices, equipment and systems of the type and scope specified herein, who has fully staffed and equipped maintenance and repair facility, and who is licensed to perform work of this type in the project jurisdiction.

- D. The contractor shall use a sufficient number of skilled workers who are thoroughly trained and experienced in the necessary crafts, who are completely familiar with the specified requirements, and the methods needed for proper performance of the work in this section. These personnel shall have at least two (2) years direct experience in similar work, evidence of which shall be verified in writing with appropriate references.
- E. The Owner may request a prospective Contractor to provide additional information as desired for review by the Owner and Architect to make a determination of the Audio-Video Contractor's acceptability.
- F. Other Contractors bidding this work who cannot meet the above qualifications must employ the services of a qualified Contractor who meets the above qualifications.

1.04 SUBMITTALS

- A. For Review:
 - 1. Product data sheets of all components
- B. To be included in Record and Information Manuals:
 - 1. One (1) copy of each approved submittal
 - 2. Test results
 - 3. Certificate of System Completion

1.05 MANUFACTURERS/VENDORS

- A. As listed below.
- B. All products, whether Basis-of-Design or otherwise, shall be the most current model at time of installation.

PART 2 PRODUCTS

2.01 DISPLAY MONITORS

- A. The Display Monitors shall be provided by the Contractor and shall meet or exceed the following minimum specifications:
 - 1. Screen Size - Diagonal from 40 to 98 inches
 - 2. Aspect Ratio – 16:9
 - 3. Resolution – 3840x2160
 - 4. Contrast Ratio – 5000:1
 - 5. All Display Monitors used for Signage shall be rated for minimum 16/7 operation.
 - 6. Shall support a minimum of (2) HDMI inputs, audio output, RS-232C, and (1) USB port.
 - 7. Supports over-the-air TV, streaming channels, and applications.
 - 8. LAN connection RJ45
 - 9. Refer to drawings for size and location.
 - 10. Contractor shall mount monitors using factory approved mounting brackets
 - 11. At a minimum, the Monitor Display shall be a Commercial grade LED Monitor
 - 12. Approved Manufacturers: Philips, Samsung, LG, NEC, Panasonic, or Engineer-approved equivalent

- B. The Display Monitor mount shall be a thin wall mount to meet ADA requirements where necessary and tilt mounts in all other locations
 - 1. ADA Compliant mounts shall be satisfactory wall mounting unit rated for the Monitor Display brand and weight.
 - 2. The mount shall be approved by monitor manufacturer and manufactured by one of these manufacturers
 - a. Chief
 - b. Peerless,
 - c. Omni Mount
 - d. Monoprice
 - e. Engineer approved equivalent

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install flat screen television panes where shown on the Drawings and specified.
- B. Coordinate with the General Contractor that mount plates have been installed behind the sheetrock to support the weight of the television wall mount bracket and Monitor Display.
- C. Mount Monitor Display on wall bracket, unit shall be permanently mounted, vertical and horizontal to floor and walls.
- D. Connect all cabling in a neat and orderly fashion so they are not exposed around the edges of the display.

3.02 TESTING

- A. Provide a complete functional test of all components in accordance with manufacturer's recommendations.
- B. Operate system for a minimum of seven (7) consecutive days with no problems before claiming contract completion.
- C. Refer to Section 26 08 40, "Electrical Tests, Adjustments, Inspection."

3.03 EQUIPMENT DEMONSTRATION

- A. After all system tests have been completed, schedule an instruction period with the Owner. Instruction to be provided by manufacturer's authorized field technician.
- B. Instruction shall include:
 - 1. Location of all components of the system and explanation of their function
 - 2. Demonstration of equipment
 - 3. Maintenance and repair procedures
 - 4. Programming procedures
 - 5. Review of documents in Record and Information Manuals

- C. Provide a minimum of two (2) hours training, record in digital format, and turn over to the Owner.

END OF SECTION

SECTION 28 00 00 - DIVISION 28 - ELECTRONIC SAFETY AND SECURITY INTRODUCTORY STATEMENT

PART 1 GENERAL

1.01 REQUIREMENTS

- A. All work included under this heading is subject to the Bidding Requirements, the Instructions to Bidders, the General Conditions, and/or the Division 1 General Requirements written for this entire Specification and shall apply to all work herein.
- B. In addition to conforming to the documents listed in Paragraph 1.01 A. above, the work performed by the Division 28 Contractor shall conform to all provisions of Sections 28 00 00 through 28 99 99 as included and made part of this Specification. The Division 28 Contractor is to consider the word "Contractor" when used in these Sections to mean himself/herself.
- C. The Division 28 Contractor must read the Specifications of all divisions, because they will be responsible for any and all work described in other Sections where reference is made to Division 28 and/or Electronic Safety and Security Contractor.

1.02 APPLICABLE SECTIONS

- A. Division 28 Contractor shall perform work described in the preceding paragraphs, and as it relates to Division 28 work in the following Sections (as included):
 - 27 00 00 Communications Introductory Statement
 - 27 10 00 Structured Cabling
- B. Where reference is made to the Division 27 Contractor in the above applicable Division 27 Specification Sections, it shall be construed to mean Division 28 Contractor.

1.03 RESPONSIBILITY

- A. The Engineer's efforts under this Contract are aimed at designing a project that will be safe during construction and after full completion of the project. The Engineer has no expertise in, and takes no responsibility for, construction means and methods or job site safety during construction, which are exclusively the Contractor's responsibility. Processing and/or approving submittals made by the Contractor which may contain information related to construction methods or safety issues, or participation in meetings where such issues might be discussed must not be construed as voluntary assumption by the Engineer of any responsibility for safety procedures.
- B. If a conflict occurs between the Drawings and/or the Specifications, immediately call the conflict to the attention of the Architect at least ten (10) days before bids are submitted, so an addendum clarification may be issued. Conflicts not brought to the Architect's attention before bids are due, shall be priced by the Contractor to include the most expensive, highest quality and quantity of the conflicting items in question.

END OF SECTION

SECTION 28 00 15 - SUBMITTALS

PART 1 GENERAL

1.01 DESCRIPTION

- A. Refer to the GENERAL CONDITIONS and Division 1 for general requirements.
- B. Materials and equipment installed in this work shall meet all the requirements of the Contract Documents and no materials or equipment shall be ordered until submittals are reviewed and approved by the Architect and Engineer.
- C. Submit complete catalog data or shop drawings for each manufactured item of equipment and all components to be used in the work, including specific performance data, material description, rating, capacity, working pressure, dimensional data, material gauge or thickness, wiring diagrams, brand name, catalog number, and general type.
- D. Catalog data for equipment reviewed by the Engineer shall not take precedence over the requirements of the Contract Documents. The review of the Engineer shall not relieve the Contractor from the responsibility for deviations from Drawings or Specifications, nor from the responsibility for providing proper clearance and coordination with other Trades.
- E. When submitted for review, all shop drawings shall bear the Contractor's signed certification that he/she has reviewed, checked, and approved the shop drawings, that they have been coordinated with the requirements of the project and with the provisions of the Contract Documents, and that he/she has verified all field measurements and construction criteria, materials, catalog numbers, and similar data. Annotations shall be in red ink.
- F. Each required Specification Section submittal shall be complete with all required information included in one PDF file. External web links are not permitted. Include a transmittal cover page indicating Specification Section name and number.
- G. Submittals shall be sent to shopdrawings@korda.com.

1.02 CONTRACTOR'S RESPONSIBILITIES

- A. Complete review of shop drawings, product data, and samples prior to submission.
- B. Determine and verify:
 - 1. Field Measurements
 - 2. Field Construction Criteria
 - 3. Catalog Numbers and Similar Data
 - 4. Conformance with Specifications
- C. Coordinate each submittal with requirements of the work and the Contract Documents.
- D. Include a letter in the front of the submittal of any deviations in the submittals from the requirements of the Contract Documents.
- E. Make submittals and resubmittals, if necessary, promptly in accordance with the approved schedule and in such sequence as to cause no delay in the work or in the work of any other Contractor, or the project as a whole.

- F. Make any corrections or changes in rejected submittals as required by the Architect and resubmit until approved.
- G. Begin no fabrication or work which requires submittals until approved submittals are returned.

1.03 INCORPORATION OF SUBMITTALS INTO RECORD AND INFORMATION MANUALS

- A. Refer to Section 28 00 20, "Record and Information Manuals."

1.04 CERTIFICATIONS

- A. Provide:
 - 1. Test Agency results verifying capacities, operating conditions and power requirements at design conditions
 - 2. Manufacturer's Statement of Compliance with Standards discussed in individual Specification Sections
 - 3. Equipment labels indicating Certification requirements
 - 4. Quality standard designations on each unit piece
 - 5. Typed verification that noted mixes, chemical compositions, and testing procedures were complied with
 - 6. Other Certifications listed in other Sections of the Specifications

1.05 REQUIRED SUBMITTAL INFORMATION

- A. Submittal Transmittal
 - 1. Provide the following information on the Transmittal Form for each submittal:
 - a. Project name and address.
 - b. Specification number, as listed for each submittal item required in Paragraph 1.05C below.
 - c. Item description, as listed for each submittal item required in Paragraph 1.05C below. Where equipment is identified by number or tag on the documents, same shall be indicated on the submittal.
 - d. Specification number and item description (b and c, above) for each submittal if more than one submittal is sent under one transmittal form.
 - e. Name, address and telephone number of Contractor.
 - f. Bid package number (if applicable).
 - 2. Submittal Transmittal Forms not properly identified with the above information will be returned (without review) to the Contractor.

- B. Refer to the following letter key:

KEY FOR REQUIRED SUBMITTALS:

- A. Shop Drawings and/or Layout Drawings
- B. Product Data Sheets
- C. Wiring Diagrams
- D. Installation, Operation, and Maintenance Instructions (Due at the end of project)
- E. Reports or Test results (Due at the end of project)

- C. Submit information on equipment items as listed below.

SECTION #	CONTRACT ITEM	SUBMITTALS REQUIRED
28 00 20	RECORD AND INFORMATION MANUALS	A, B, C, D
28 13 00	SECURITY AND ACCESS CONTROL SYSTEM	A, B, C, D

28 15 23	AUDIO/VIDEO INTERCOM SYSTEM	A, B, C, D, E
28 23 00	VIDEO SURVEILLANCE SYSTEM	B, C, D
28 81 15	EMERGENCY RESPONDER RADIO ANTENNA REPEATER SYSTEM	A, B, C, D, E
28 81 18	RF SURVEY FOR EMERGENCY RESPONDER RADIO ANTENNA REPEATER SYSTEM	E

- D. After approval, one (1) copy shall be returned to the Contractor. Contractor shall make prints of the approved transparencies and reproductions of all other shop drawing information as necessary for his/her use and for inclusion in the Record and Information Manuals.

END OF SECTION

SECTION 28 00 20 - RECORD AND INFORMATION MANUALS

PART 1 GENERAL

1.01 RECORD DRAWINGS

- A. Refer to Division 1 for general requirements as well as for specific information regarding Record (As-Built) Drawings. All drawings shall be provided in electronic PDF format.

1.02 OPERATION AND MAINTENANCE MANUALS

- A. Refer to Division 1 for general requirements and for specific information regarding Operation and Maintenance Manuals, including required format(s) (paper and/or electronic) and quantity. If no such requirements are listed in Division 1, provide in electronic format. Submit one (1) copy of draft manual to the Architect for review and approval thirty (30) days before final inspection is due. After approval, submit three (3) approved manuals to the Owner and obtain receipt.
- B. Paper Copy Manuals shall be loose leaf, three-ring, heavy-duty hard-cover binders. Material shall be typewritten or printed and be fully legible. Each section shall be divided by labeled tabs.
- C. Electronic Copy Manuals shall be PDF file format. Individual documents shall have filenames corresponding to specification sections and system names. Each document shall have bookmarks corresponding to the systems, subsystems, and equipment names. Use electronic files prepared by manufacturers where available.
- D. The following items, together with any other necessary pertinent data, shall be included in each Manual:
 - 1. Each manual shall be labeled on front cover with project name, Contract, Contractor's name, Architect, Engineer, and date of project completion.
 - 2. Manufacturers' names, nearest Factory Representative, and model and serial numbers of components of systems
 - 3. Operating instructions, start-up and shutdown procedures
 - 4. Maintenance instructions
 - 5. Routine and 24 hour emergency service/repair information:
 - a. Name, address, and telephone number of servicing agency
 - b. Names of personnel to be contacted for service arrangements
 - 6. Parts list with numbers of replaceable items, including sources of supply
 - 7. Manufacturers' literature describing each piece of equipment
 - 8. One (1) approved copy of each submittal
 - 9. Written warranties
 - 10. Certificate of Material Receipt and Certificate of System Completion
 - 11. Record (As-Built) Drawings
 - 12. IP and MAC address identified for each item required to have an address
 - 13. Certificate of Final Inspection signed by Building Authority Having Jurisdiction
 - 14. Test results
 - 15. Video recordings of all equipment demonstrations and training sessions

END OF SECTION

SECTION 28 13 00 - SECURITY AND ACCESS CONTROL SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION

- A. Division 28 Contractor shall furnish and install a complete Security and Access Control System as shown on the Drawings and as specified herein. Provide all accessories and equipment as necessary for a complete system.
- B. System shall be complete with control panels, door contacts, keypads, power supplies, batteries, supervised wiring, and all other items required for a complete fully functioning system.
- C. The system shall connect to all reader and alarming devices to support the following:
 - 1. The system shall support cards, fobs, and smartphones with the following specifications:
 - a. MIFARE DESFire, MIFARE Plus (13.56 MHz),
 - b. NFC
- D. Electric strikes/latches are provided by the door hardware supplier. This Contractor is required to coordinate with door hardware supplier and Division 26 Contractor, and is responsible for final connections to access control system including integration with automatic handicap door operators.
- E. The Security System shall be designed and installed to not interfere with egress requirements for life safety nor interfere with intrusion or fire alarm systems.

1.02 QUALITY ASSURANCE

- A. The system shall be UL listed and approved for the application intended and shall be compliant with all standards and regulations that may apply. These listing and approvals shall include, but not be limited to, FCC, CE, UL 1950, UL 294, and UL 1076. The latter UL 1076 will be applied only to the overall system, including the host when available.
- B. Contractor shall be certified with the equipment manufacturer that is being installed.

1.03 SUBMITTALS

- A. For Review:
 - 1. Product data sheets of all components
 - 2. Wiring Diagrams
 - 3. Full Size Layout Drawings
- B. To be included in Record and Information Manuals:
 - 1. One (1) copy of each approved submittal
 - 2. Test results
 - 3. Certificate of System Completion
 - 4. Certificate of Material Receipt

1.04 MANUFACTURERS

- A. Security and Access Control System
 - 1. Butterfly
 - 2. No equivalent manufacturers

PART 2 PRODUCTS

2.01 CLOUD-BASED CONTROLLER

- A. Each controller shall support up to two doors and shall have the following specifications:
 - 1. Support for all types of doors
 - 2. Secure offline mode support
 - 3. Unlimited encrypted code storage for offline use
 - 4. Unlimited encrypted fob/card storage for offline use
 - 5. Smart open/close schedule
 - 6. 2 peripheral inputs
 - 7. 2 wet relay outputs (12VDC, 1A)
 - 8. 2 dry relay outputs
 - 9. 2 REX inputs
 - 10. 2 auxiliary relay outputs
 - 11. Fire switch override input
 - 12. Ethernet port (RJ45) input
 - 13. Battery backup input
 - 14. Power input with a barrel connector
 - 15. 12 VCA 5A DC input
- B. Inputs include:
 - 1. REX (motion) sensor compatible
 - 2. Emergency unlock switch
 - 3. Fire exit momentary switch
 - 4. Push to exit button
 - 5. Power: 12VDC, 2A (included)
 - 6. Door state sensor
- C. Outputs include:
 - 1. Electric strike
 - 2. Magnetic lock
 - 3. Electric push/crash bars
 - 4. Elevator panels
 - 5. Gates/garage controllers
 - 6. Dry relay
- D. Offline mode shall provide access when the internet is down or the power goes out (with battery backup installed).
- E. The Contractor shall include all power supplies, batteries and other peripheral devices required to provide a fully functional system as described herein, and indicated on the Drawings.
- F. The system shall support user interaction by way of readers, smartphone apps, and web browsers.

- G. Remote management access shall allow management of credentials, reviewing entry logs, and granting access from any smartphone or computer.

2.02 CREDENTIAL READERS AND CREDENTIALS

- A. The credential reader shall be a read only multi-technology contactless smart card reader and be designed to securely read, interpret, and authenticate access control data from 13.56 MHz contactless credentials and smartphone mobile credentials via NFC and Bluetooth. Readers shall be indoor and outdoor rated.
 - 1. Single gang readers
 - a. Use in all general application card reader locations unless a keypad or mullion type are needed.
 - 2. Keypad readers
 - a. Use where keypad pins are required in addition to smartphone mobile credentials.
 - 3. Mullion readers
 - a. Use where a narrow device is needed in a mullion or comparable application.
- B. The credential shall be users' smartphone devices used as a mobile credential.

2.03 UNINTERUPPED POWER SUPPLIES (UPS)

- A. Provide UPS's with batteries and battery charger as required to provide operation of the security system in the event of a power failure.
 - 1. All units whether enclosed in a single housing or utilizing a master slave configuration shall utilize a standard EIA 19" rack mount width and mounting hardware.
 - 2. All units shall be designed for operation on a nominal 120VAC system, with an input range of $\pm 20\%$.
 - 3. All units shall contain a sealed maintenance free, lead acid battery.
 - 4. All units shall provide both local LED status display, and accessibility via an RJ-45 (8P8C) connector for remote monitoring and shutdown of the unit. Units shall also contain an audible alarm to be annunciated for all alarm conditions.
 - 5. All units shall be compliant with all applicable UL, cUL and IEC ratings and listings.
 - 6. All units shall have fully on-line double conversion operation.
 - 7. Unless otherwise noted on the Drawings, all units shall be sized for a 90 minute run time based on the assigned load with a 20% growth factor. Output capacity has been calculated based on the apparent connected load. The Contractor shall verify the actual load prior to bidding based on the switches being provided and increase any explicit sizing called for on the drawings based on actual installation conditions at no additional cost to the Owner.
 - 8. All units shall provide an SNMP module and Ethernet interface for remote monitoring and orderly shutdown.
 - 9. Acceptable Manufacturers APC, Trip Lite or Liebert

2.04 SMARTHOME HUBS

- A. Division 28 Contractor shall provide (1) Z-Wave hub per unit, plus spare devices listed below. Z-Wave hub shall be compatible with both the Division 8 wireless deadbolt unit locks and the Butterfly System / App. Basis of Design is Ezlo Plus Smart Home Hub.

2.05 MISCELLANEOUS EQUIPMENT

- A. Provide all cabling required for installation of complete system.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Division 28 Contractor shall install Security System as shown on the Drawings in accordance with Manufacturer's written instructions.
- B. All delayed egress equipped doors will be monitored by the Security System for device power supply status, fire alarm relay status, device arm/disarm status, device alarm status, and door position.
- C. Install and configure UPS systems.

3.02 TESTING

- A. Division 28 Contractor shall provide a complete functional test of all components in accordance with Manufacturer's recommendations.
- B. Operate system for a minimum of seven (7) consecutive days with no problems before claiming Contract Completion.

3.03 SPARE PARTS

- A. Division 28 Contractor shall furnish one (1) spare device for each type used, including single gang reader, controller, and door contacts.
- B. Division 28 Contractor shall furnish (3) spare Z-Wave hubs.

3.04 EQUIPMENT DEMONSTRATION

- A. After all system tests have been completed, schedule an instruction period with the Owner. Instruction to be provided by Manufacturer's authorized field technician. Provide four separate sessions of four hours. Record sessions on DVD and furnish two copies to Owner.
- B. Instruction shall include:
 - 1. Location of all components of the system and explanation of their function
 - 2. Demonstration of equipment
 - 3. Maintenance and repair procedures
 - 4. Programming procedures
 - 5. Review of documents in Record and Information Manuals

3.05 WARRANTY OF WORK

- A. The Division 28 Contractor shall warrant all materials, equipment, and workmanship for a period of one (1) year from date of completion. Refer to Section 28 00 00.

END OF SECTION

SECTION 28 15 23 - AUDIO/VIDEO INTERCOM SYSTEM

PART 1 GENERAL

1.01 REQUIREMENTS

- A. The Contractor shall comply with Section 28 00 00, "Division 28 - Communications Introductory Statement" of Division 28 Specifications.
- B. This Specification describes the product and execution requirements related to furnishing and installing the audio/video intercom system as shown on the Drawings and specified herein.

1.02 SCOPE OF WORK

- A. It is the intent of this Specification to spell out the minimum acceptable requirements for the audio/video intercom system to be provided for this project.
- B. Division 28 Contractor shall provide and install a complete audio/video intercom system, providing all hardware, software, brackets, backboxes, peripherals, and equipment as shown on the Drawings or required for a complete functional system.
- C. IP Network Compatible Video Intercom System: A network-based communication and security system featuring video entry security and communication.
- D. All stations shall be flush mounted where wall space is available.
- E. Low-voltage/access control contractor installs the ButterflyMX Smart Intercom according to the technical requirements of the system and integrates it with the building's access control and network communication systems. This includes the cabling needed for dedicated power (varies based on the distance of the cable run), data (Cat, minimum bandwidth 2 Mb/s upload/download speed), and REX (request-to-exit, 18/2), UPS (uninterruptible power supply, minimum 600va/300w), networking hardware/configuration, any peripherals required for a safe, secure, environmentally suitable mounting location, and any peripherals required for integrating the Smart Intercom's dry contact relays with either an access control system's dry contact REX inputs or an electric door lock for REX (isolation relay, diode or resistor).
- F. Low voltage/access control contractor may install a ButterflyMX Smart Intercom at each secured visitor access point in a building. Drawings specify diagonal screen size (8" or 12"). Stations shall be recessed mounting type. Each configuration includes a high-quality capacitive touchscreen, USB-camera capable of reading QR codes, speaker/microphone, RJ45 connector, and 4 dry contact relays.

1.03 MOUNTING HEIGHT/LOCATION

- A. The Contractor shall mount the door station at ADA required height (48 inches AFF to top of useable screen).

PART 2 PRODUCTS

2.01 SMALL INTERCOM STATION

- A. The small intercom station is an IP addressable video station with a 8" color LCD capacitive touchscreen. Power to be supplied is 24 VDC backed up via UPS power. The station connects directly to a network using CAT-6 cable. The intercom shall be surface-mounted and provided with a corresponding backbox.
- B. Provide remote selective door release.
- C. Basis for design: ButterflyMX 8" Surface Mount Intercom
- D. No equivalent manufacturers

2.02 LARGE INTERCOM STATION

- A. The large intercom station is an IP addressable video station with an 12" color LCD capacitive touchscreen. Power to be supplied is 24 VDC backed up via UPS power. The station connects directly to a network using CAT-6 cable. The intercom shall be surface-mounted and provided with a corresponding backbox.
- B. Provide remote selective door release.
- C. Basis for design: ButterflyMX 12" Surface Mount Intercom
- D. No equivalent manufacturers

2.03 PACKAGE ROOM STATION

- A. The package room station is an IP addressable video station with a 8" color LCD capacitive touchscreen. It is the 8" intercom station with a specific graphic user interface (GUI) loaded. Power to be supplied is 24 VDC backed up via UPS power. The station connects directly to a network using CAT-6 cable. The intercom shall be surface-mounted and provided with a corresponding backbox.
- B. Provide door release.
- C. Basis for design: ButterflyMX 8" Package Room
- D. No equivalent manufacturers

2.04 UPS

- A. A UPS is required for each station to protect it from voltage surges and drops. For each station, a minimum 600 VA / 300W UPS shall be provided.

2.05 RESIDENT MOBILE APP

- A. Residents use the ButterflyMX app on their smartphone or tablet to interface with visitors and grant themselves access to the building. Residents have access to the following features unless the decision is made by building management not to offer any of the following functionalities:
 - 1. Door Pins: a 6-digit pin code that resident may enter using the Smart Intercom touchscreen to access the door. Door pins are stored locally; residents can use the door pin even in the event of an internet outage.
 - 2. Virtual Keys: a customizable QR code created by residents inside the ButterflyMX mobile app and sent via SMS to visitors who need recurring and regular access to the building.
- B. Residents always have access to the following features:
 - 1. Swipe-to-open: a feature of the mobile app that allows residents to "swipe-to-open" the door. The swipe bar instructs the Smart Intercom to unlock a door.
 - 2. Live View: a feature of the mobile app that allows residents to view a live video feed from the Smart Intercom.
 - 3. Open Door: a feature of the mobile app that allows the resident to open the door while on a call with the visitor. A UPS is required for each station to protect it from voltage surges and drops.

2.06 CABLING

- A. No cabling shall be run in open visible areas. Cable shall be either in conduit or j-hooks.
- B. Conduits from door position switch, electric door lock and intercom station location at door shall be 3/4 inch. Install in mullion or door frame as needed to conceal and coordinate with Owner's field representative.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install the audio/video intercom system in the locations shown on the Drawings and as specified herein. The system shall be installed per the manufacturer's specifications and wiring diagrams and the manufacturer's written instructions.
- B. All wiring shall be in accordance with this specification and Section 28 00 00, "Division 28-Electronic Safety and Security Introductory Statement Introductory Statement."
- C. Wire system to door electronic latch for unlocking door.

3.02 TESTING

- A. Provide a complete functional test of all components in accordance with manufacturer's recommendations.
- B. Operate system for a minimum of seven (7) consecutive days with no problems before final acceptance by Owner.

3.03 EQUIPMENT DEMONSTRATION

- A. After all system tests have been completed, schedule an instruction period with the Owner. Instruction to be provided by manufacturer's authorized field technician.
- B. Instruction shall include:
 - 1. Location of all components of the system and explanation of their function.
 - 2. Demonstration of equipment with extensive training on programming.
 - 3. Maintenance and repair procedures.
 - 4. Review of documents in Record and Information Manuals.

3.04 EXTENDED WARRANTY

- A. Provide a two (2) year extended warranty against defects in materials and workmanship.

END OF SECTION

SECTION 28 23 00 - VIDEO SURVEILLANCE SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION

- A. Furnish and install a complete IP Video Surveillance System as shown on the Drawings and as specified herein. Provide all accessories and equipment as necessary for a complete system.
- B. The Surveillance System shall utilize IP-based cameras to monitor the internal and external areas of the facility. The activity shall be recorded onto a network video recorder (NVR) that will be connected to the Owner's network. Viewing and/or control shall occur by means of a software client loaded onto assigned PC's. Viewing only shall be capable by means of a web-based interface, and/or by means of smartphones and tablets utilizing both Apple iOS and/or Android operating systems.

1.02 QUALITY ASSURANCE

- A. All equipment shall be UL listed and labeled and in accordance with applicable NEMA and ANSI Standards.
- B. Contractor shall be certified with the equipment manufacturer that is being installed.

1.03 SUBMITTALS

- A. For Review:
 - 1. Product data sheets of all components
 - 2. Wiring Diagrams
 - 3. Schematic Block diagrams
 - 4. Network bandwidth calculation
 - 5. Digital video storage calculation
 - 6. Copies of all certifications
- B. To be included in Record and Information Manuals:
 - 1. One (1) copy of each approved submittal
 - 2. Test results
 - 3. Certificate of System Completion

1.04 MANUFACTURERS

- A. As listed within. Basis of design listed is intended to meet the minimum requirements. Other acceptable manufacturers are as noted.

PART 2 PRODUCTS

2.01 IP CAMERA SYSTEM

- A. The system shall be a complete IP based video surveillance system that shall utilize the Owner's network as the method of transport to a video surveillance server that shall record and retain the video and provide an export capability to transfer files that the Owner wishes to record to their choice of media.

B. Cameras

1. All Cameras shall utilize Internet Protocol as the transport for the video signaling.
2. The cameras shall meet or exceed the following performance requirements and criteria.
3. 2MP Varifocal Indoor / Outdoor Dome Camera:
 - a. Image Sensor: 1/2.8" 2MP CMOS
 - b. Lens: 3.3 ~ 10.3mm (3.1x) motorized varifocal
 - c. Horizontal Angle of View: 105.2°(Wide) ~ 30.6°(Tele)
 - d. Vertical Angle of View: 54.8°(Wide) ~ 17.2°(Tele)
 - e. Compression: H.265/H.264, MJPEG
 - f. Resolution: 1920x1080 2MP
 - g. Day & Night: Auto (ICR)
 - h. Network: 10BASE-T / 100BASE-TX (RJ-45)
 - i. PoE: IEEE802.3af compliant
 - j. Vandal Resistant: Yes, IK10
 - k. Environmental: IP66 rated for outdoor use
 - l. Basis of Design: Hanwha Techwin ANV-L6082R
4. 6MP 360-Degree Fisheye Outdoor Camera:
 - a. Image Sensor: 1/1.8" 6MP CMOS
 - b. Lens: 1.6mm fixed
 - c. Angular Field of View: H: 192° / V: 192° / D: 192°
 - d. Compression: H.265/H.264, MJPEG
 - e. Resolution: 2048 x 2048 6MP
 - f. Day & Night: Auto (ICR)
 - g. Network: 10BASE-T / 100BASE-TX (RJ-45)
 - h. PoE: IEEE802.3af compliant
 - i. Vandal Resistant: Yes, IK10
 - j. Environmental: IP66 rated for outdoor use
 - k. Basis of Design: Hanwha Techwin XNF-8010RV
5. Equivalents by Axis, Avigilon and Bosch / Sony
6. Provide enclosures and appropriate mounting bracket for each camera provided based on the location and environment of the installation location. Refer to drawings for camera mounting details and schedule. All exterior wall mount cameras shall be installed with an exterior wall mount kit such that the camera is horizontally mounted (not vertically mounted on the wall). For exterior ceiling mount camera locations where installed on a gable or sloped ceiling, ensure that camera view will be level to the ground by either (a) rotating the camera lens or (b) providing an appropriate pitched mount bracket to compensate for the slope.

C. Video Management Software (VMS)

1. The VMS shall manage video and event data received from cameras connected to multiple recording servers, as well as from physical security, content analytic, environmental detection, transaction and other enterprise systems.
2. The VMS shall allow the integration of a host of add-on components via integration tools including data link integration events, API commands, contact closure and more.
3. The VMS shall run on off-the-shelf PC hardware and support all leading manufacturers' cameras and devices (over 1500 models), as well as all industry standard compression formats (MPEG4, MJPEG, H.263, H.264 and H.265)
4. The VMS system resources shall be optimized through per camera configuration for compression level/format, image resolution, bandwidth, frame rate, conditional recording, retention time, archiving frequency, archiving location and more.
5. The VMS shall operate so all recording servers and client users are managed by the base, which coordinates all event and alert handling, manages users' rights to specific cameras and functions system wide (Active Directory supported), and distributes all shared assets

6. The VMS shall function so storage, based on either size or retention period, is allocated per camera or camera group, with prioritization of important cameras. Video can be stored on local or network drives, using a database structure that eliminates the distinction between 'live recording' and 'archived' video.
 7. The VMS shall have a system-wide repository for shared assets management, including maps for easy navigation to cameras, icons and events tagging/classification tables.
 8. The VMS shall provide free client software capable of operating on Windows, Linux, or Mac and have the following additional features:
 - a. Event Management
 - b. Event Prioritization
 - c. Composite Events (linking events or alerts)
 - d. Push video alerting
 - e. Management of Users, User Groups and Authorizations
 9. The VMS server software shall provide the following features as a minimum:
 - a. System
 - 1) One server connection per client
 - 2) Browser-based viewing of live and stored video
 - 3) Auto detection of supported cameras
 - 4) Support for fish-eye and panoramic lens cameras
 - 5) Client bandwidth throttling
 - 6) Soft triggers
 - 7) Pre and post alarm recording
 - 8) Continuous motion, time or alarm-based recording, configurable per camera
 10. The VMS shall be capable of providing the following Actions on an event:
 - a. Send email notification to one or more recipients
 - b. Move PTZ camera to preset
 - c. Send HTTP GET/POST request
 - d. Send TCP/UDP package
 - e. Send event camera(s) to remote Video wall
 11. The VMS shall support the recording, viewing, archiving, and configuring of at least the camera manufacturer that is chosen.
 12. The VMS shall support access for mobile devices (Smartphone, touch pads etc.) with proper authentication.
 13. The contractor shall provide, if not existing, a base server with the latest requirements recommended by the manufacture.
 14. Acceptable Manufacturer and Product shall be:
 - a. Wisenet WAVE
 - b. Exacq
 - c. Milestone
 - d. OnSSI
 - e. Salient
 - f. Engineer-approved equivalent
- D. Network Video Recorder Hardware (NVR)
1. The NVR shall be a rack mounted unit capable of being installed in an EIA standard 19" rack without the use of custom mounting hardware with the exception of commercial, off the shelf, rack mount hardware from the NVR server manufacturer. Each NVR shall have Scalable Architecture with unlimited number of cameras, connected to multiple recording servers (up to 64 cameras per server) at multiple sites; support for MJPEG, MPEG4, H.263 and H.264 compression formats, at image resolutions up to 5MP (and higher) and frame rates of 30 fps or more; support for analog cameras via a wide range of IP video encoders.

2. The Network Video Recorder ("NVR") shall be an appliance to acquire, record, store, and display video signals from both directly connected analog cameras and IP network video cameras and encoders.
3. Each NVR shall be configured via an administration utility for setup and configuration of cameras and I/O devices, camera event settings, archive settings, scheduling, and soft buttons for manually triggered events.
4. Each NVR shall automatically discover and detect cameras and other devices based on user preferences and have the following other features
 - a. Batch Device Configuration
 - b. Export/import of configuration data
 - c. Set automatic system restore points
 - d. Recording and Archiving
 - e. Maintenance-Free, Transparent Archiving
 - f. Multi/dual-stream support
 - g. Support for DNS and NAT (Network Address Translation.)
 - h. PTZ Preset Settings
 - i. PTZ Patrols
 - j. Two way audio
 - k. Networking: Support for Multi-Network operation
 - l. Detailed logging
 - m. Advanced Motion Detection with three resolution levels of motion detection.
5. Each NVR shall have no limit on the number of concurrent client users, and no incremental cost for additional Clients.
6. Each NVR shall support up to eight connected displays.
7. The NVR shall be configured with RAID-5 storage. The RAID-5 storage shall be internal to the server and shall provide notification of a drive failure to the administrator.
8. The NVR shall be sized to accommodate all new cameras as well as 30% spare capacity. Assume 70% motion for all cameras. Cameras to record substream at all times at full frame rate and low resolution. Cameras to record mainstream on motion detection at 15 fps and full resolution. Size for 30 days of storage.
9. In addition to the previously declared requirements of the NVR, it must meet all specifications set by the manufacturer.
10. Acceptable Manufacturer shall be VMS/Camera Manufacturer Recommended Product

PART 3 EXECUTION

3.01 APPLICATION

- A. Provide IP cameras with lenses appropriate for the areas to be covered.

3.02 INSTALLATION

- A. Install Video Surveillance System as shown on the Drawings in accordance with manufacturer's written instructions.
- B. Provide 120 volt power to all equipment from nearest emergency circuit.
- C. Provide grounding of all equipment in accordance with ANSI/EIA/TIA-607.
- D. Coordinate Camera height with owner before securing.
- E. Install all components in cabinets and racks.

- F. Coordinate complete system installation with Owner's representative.
- G. Install Ethernet Switches and validate connectivity throughout. Configure all VLANs, IP Routing, and IP Subnets.
- H. Provide all required Integration Services to setup and program the Network (IP addresses, VLAN's, Routing, Wireless Surveys, etc.).
- I. Contractor shall supply the "latest" software updates as part of the system configuration for two (2) years after system acceptance.

3.03 TESTING

- A. Provide a complete functional test of all components in accordance with manufacturer's recommendations.
- B. Operate system for a minimum of seven (7) consecutive days with no problems before claiming contract completion.

3.04 EQUIPMENT DEMONSTRATION

- A. After all system tests have been completed, schedule an instruction period with the Owner. Instruction to be provided by manufacturer's authorized field technician. Include four (4) sessions of four (4) hours each on different days.
- B. Instruction shall include:
 - 1. Location of all components of the system and explanation of their function
 - 2. Demonstration of equipment
 - 3. Maintenance and repair procedures
 - 4. Programming procedures
 - 5. Review of documents in Record and Information Manuals

3.05 WARRANTY OF WORK

- A. Contractor shall warrant all materials, equipment, and workmanship for a period of one (1) year from date of completion.

END OF SECTION

SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Nonsystem smoke detectors.
5. Heat detectors.
6. Notification appliances.
7. Magnetic door holders.
8. Remote annunciator.
9. Addressable interface device.
10. Digital alarm communicator transmitter.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including furnished options and accessories.

B. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery-size calculations.
7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.
 - a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
 - b. Show field wiring required for HVAC unit shutdown on alarm.
 - c. Locate detectors according to manufacturer's written recommendations.
12. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified, fire-alarm technician; Level III minimum.
 - c. Licensed or certified by authorities having jurisdiction.

D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.
- C. Field quality-control reports.
- D. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
 - c. Complete wiring diagrams showing connections between all devices and equipment.
 - d. Riser diagram.
 - e. Record copy of site-specific software.
 - f. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:

- 1) Equipment tested.
- 2) Frequency of testing of installed components.
- 3) Frequency of inspection of installed components.
- 4) Requirements and recommendations related to results of maintenance.
- 5) Manufacturer's user training manuals.

- g. Manufacturer's required maintenance related to system warranty requirements.
- h. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.
- C. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).
- D. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.
- E. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FM Global-approved alarm company.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.
 1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
 2. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.

- B. Noncoded, UL-certified addressable system, with multiplexed signal transmission and horn/strobe evacuation.
- C. Automatic sensitivity control of certain smoke detectors.
- D. All components provided shall be listed for use with the selected system.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:
 - 1. Manual stations.
 - 2. Heat detectors.
 - 3. Smoke detectors.
 - 4. Duct smoke detectors.
 - 5. Carbon monoxide detectors.
 - 6. Automatic sprinkler system water flow.
 - 7. Fire-extinguishing system operation.
 - 8. Fire standpipe system.
 - 9. Dry system pressure flow switch.
- B. Fire-alarm signal shall initiate the following actions:
 - 1. Continuously operate alarm notification appliances.
 - 2. Identify alarm and specific initiating device at fire-alarm control unit and remote annunciators if included.
 - 3. Transmit an alarm signal to the remote alarm receiving station.
 - 4. Unlock electric door locks in designated egress paths.
 - 5. Release fire and smoke doors held open by magnetic door holders.
 - 6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
 - 7. Close smoke dampers in air ducts of designated air-conditioning duct systems.
 - 8. Activate preaction system.
 - 9. Recall elevators to primary or alternate recall floors.
 - 10. Activate elevator power shunt trip.
 - 11. Activate emergency lighting control.
 - 12. Activate emergency shutoffs for gas and fuel supplies.
 - 13. Record events in the system memory.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
 - 1. Valve supervisory switch.
 - 2. High- or low-air-pressure switch of a dry-pipe or preaction sprinkler system.
 - 3. Elevator shunt-trip supervision.
 - 4. Loss of communication with any panel on the network.
- D. System trouble signal initiation shall be by one or more of the following devices and actions:
 - 1. Open circuits, shorts, and grounds in designated circuits.
 - 2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.

3. Loss of communication with any addressable sensor, input module, relay, control module, or remote annunciator.
4. Loss of primary power at fire-alarm control unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.
6. Abnormal ac voltage at fire-alarm control unit.
7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Supervisory Signal Actions:

1. Initiate notification appliances.
2. Identify specific device initiating the event at fire-alarm control unit and remote annunciators.
3. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.

2.3 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.
2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

C. Notification-Appliance Circuit:

1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
2. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.

D. Elevator Recall:

1. Elevator recall shall be initiated only by one of the following alarm-initiating devices:
 - a. Elevator lobby detectors except the lobby detector on the designated floor.
 - b. Smoke detector in elevator machine room.

- c. Smoke detectors in elevator hoistway.
- 2. Elevator controller shall be programmed to move the cars to the alternate recall floor if lobby detectors located on the designated recall floors are activated.
- 3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.
 - a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.
- E. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls shall be connected to fire-alarm system.
- F. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory.
- G. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
- H. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals, supervisory and digital alarm communicator transmitters and digital alarm radio transmitters shall be powered by 24-V dc source.
 - 1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
- I. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

2.4 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38.
 - 1. Single-action mechanism; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 - 2. Station Reset: Key- or wrench-operated switch.

2.5 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
 - 1. Comply with UL 268; operating at 24-V dc, nominal.
 - 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
 - 3. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 - 4. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.

5. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
 6. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition.
 - a. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.
 - b. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).
 - c. Multiple levels of detection sensitivity for each sensor.
 - d. Sensitivity levels based on time of day.
- B. Photoelectric Smoke Detectors:
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
- C. Ionization Smoke Detector:
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
- D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

2.6 CARBON MONOXIDE DETECTORS

A. General: Carbon monoxide detector listed for connection to fire-alarm system.

1. Mounting: Adapter plate for outlet box mounting.
2. Testable by introducing test carbon monoxide into the sensing cell.
3. Detector shall provide alarm contacts and trouble contacts.
4. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
5. Comply with UL 2075.
6. Locate, mount, and wire according to manufacturer's written instructions.
7. Provide means for addressable connection to fire-alarm system.
8. Test button simulates an alarm condition.

2.7 NONSYSTEM SMOKE ALARMS

A. General Requirements for Nonsystem Smoke Alarms:

1. Nonsystem smoke detectors shall be listed as compatible with the fire-alarm equipment installed or shall have a contact closure interface listed for the connected load.
2. Nonsystem smoke detectors shall meet the monitoring for integrity requirements in NFPA 72.

B. Single-Station Smoke Alarms:

1. Comply with UL 217; suitable for NFPA 101, residential occupancies; operating at 120-V ac with 9-V dc battery as the secondary power source. Provide with "low" or "missing" battery chirping-sound device.
2. Audible Notification Appliance: Piezoelectric sounder rated at 90 dBA at 10 feet (3 m) according to UL 464.
3. Visible Notification Appliance: 177-cd strobe.
4. Heat sensor, 135 deg F (57 deg C) fixed temperature.
5. Test Switch: Push to test; simulates smoke at rated obscuration.
6. Tandem Connection: Allow tandem connection of number of indicated detectors; alarm on one detector shall actuate notification on all connected detectors.
7. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
8. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
9. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.

C. Single-Station Duct Smoke Detectors:

1. Comply with UL 268A; operating at 120-V ac.
2. Sensor: LED or infrared light source with matching silicon-cell receiver.
 - a. Detector Sensitivity: Smoke obscuration between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) when tested according to UL 268A.
3. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. The fixed base shall be designed for mounting directly to air duct. Provide terminals in the fixed base for connection to building wiring.
 - a. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; listed for use with the supplied detector.
4. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
5. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.8 HEAT DETECTORS

- A. General Requirements for Heat Detectors: Comply with UL 521.
 1. Temperature sensors shall test for and communicate the sensitivity range of the device.
- B. Heat Detector, Combination Type: Actuated by either a fixed temperature or a rate of rise.
 1. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
- C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature.
 1. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.9 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.
- B. Chimes: Vibrating type.
- C. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464.
- D. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
 1. Mounting: Wall mounted unless otherwise indicated.

2. Flashing shall be in a temporal pattern, synchronized with other units.
3. Strobe Leads: Factory connected to screw terminals.
4. Mounting Faceplate: Factory finished.

2.10 MAGNETIC DOOR HOLDERS

- A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.
1. Electromagnets: Require no more than 3 W to develop 25-lbf (111-N) holding force.
 2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
 3. Rating: 24-V ac or dc.
 4. Rating: 120-V ac.
- B. Material and Finish: Match door hardware.

2.11 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
1. Mounting: Flush or Surface cabinet as indicated on drawings, NEMA 250, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.12 ADDRESSABLE INTERFACE DEVICE

- A. General:
1. Include address-setting means on the module.
 2. Store an internal identifying code for control panel use to identify the module type.
 3. Listed for controlling HVAC fan motor controllers.
- B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- C. Integral Relay: Capable of providing a direct signal.
1. Allow the control panel to switch the relay contacts on command.
 2. Have a minimum of two normally open and two normally closed contacts available for field wiring.
- D. Control Module:
1. Operate notification devices.
 2. Operate solenoids for use in sprinkler service.

2.13 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture one telephone lines and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
- C. Local functions and display at the digital alarm communicator transmitter shall include the following:
 - 1. Verification that both telephone lines are available.
 - 2. Programming device.
 - 3. LED display.
 - 4. Manual test report function and manual transmission clear indication.
 - 5. Communications failure with the central station or fire-alarm control unit.
- D. Digital data transmission shall include the following:
 - 1. Address of the alarm-initiating device.
 - 2. Address of the supervisory signal.
 - 3. Address of the trouble-initiating device.
 - 4. Loss of ac supply.
 - 5. Loss of power.
 - 6. Low battery.
 - 7. Abnormal test signal.
 - 8. Communication bus failure.
- E. Secondary Power: Integral rechargeable battery and automatic charger.
- F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
- B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
- C. Equipment Mounting: Install fire-alarm control unit on finished floor.
 - 1. Comply with requirements for seismic-restraint devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."

- D. Install wall-mounted equipment, with tops of cabinets not more than 78 inches (1980 mm) above the finished floor.
 - 1. Comply with requirements for seismic-restraint devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- E. Manual Fire-Alarm Boxes:
 - 1. Install manual fire-alarm box in the normal path of egress within 60 inches (1520 mm) of the exit doorway.
 - 2. Mount manual fire-alarm box on a background of a contrasting color.
 - 3. The operable part of manual fire-alarm box shall be between 42 inches (1060 mm) and 48 inches (1220 mm) above floor level. All devices shall be mounted at the same height unless otherwise indicated.
- F. Smoke- or Heat-Detector Spacing: Comply with NFPA 72.
- G. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches (9100 mm) long shall be supported at both ends.
- H. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.
- I. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.
- J. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.
- K. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.
- L. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling. Install all devices at the same height unless otherwise indicated.
- M. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.2 PATHWAYS

- A. Pathways above recessed ceilings and in nonaccessible locations may be routed exposed.
 - 1. Exposed pathways located less than 96 inches (2440 mm) above the floor shall be installed in EMT.
- B. Pathways shall be installed in EMT.
- C. Exposed EMT shall be painted red enamel.

3.3 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements. Connect hardware and devices to fire-alarm system.
 - 1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches (910 mm) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
 - 1. Smoke dampers in air ducts of designated HVAC duct systems.
 - 2. Magnetically held-open doors.
 - 3. Electronically locked doors and access gates.
 - 4. Alarm-initiating connection to elevator recall system and components.
 - 5. Alarm-initiating connection to activate emergency lighting control.
 - 6. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
 - 7. Supervisory connections at valve supervisory switches.
 - 8. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
 - 9. Supervisory connections at elevator shunt-trip breaker.
 - 10. Supervisory connections at fire-extinguisher locations.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

3.5 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
- B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.6 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by authorities having jurisdiction as required.
- B. Perform the following tests and inspections:
 - 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter.

- b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 - 2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 - 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 - 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 - 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
- C. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- D. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.
- F. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- G. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.
- 3.7 SOFTWARE SERVICE AGREEMENT
- A. Comply with UL 864.
 - B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for one year.
 - C. Upgrade Service: At Substantial Completion, update software to latest version.
- 3.8 DEMONSTRATION
- A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 283111