BIALOSKY

PROJECT MANUAL

FLEET BRANCH RENOVATION AND EXPANSION

7224 Broadway Avenue
Cleveland, Ohio 44105

Prepared For
Cleveland Public Library

Bialosky Project No: 25-25

Prepared By
Bialosky
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Cleveland, Ohio 44103

BID & PERMIT
February 27, 2026
BULLETIN 01
August 20, 2026

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AUTHOR - KEY

Abbrv.	*Author Organization Name*
A	Algebra AEC
BH	Barber & Hoffman
B	Bialosky
H	Halle's Engineering & Design
LC	LayerCake Design

ISSUE PACKAGE - KEY

Abbrv.	*Milestone Issue Title*	*Issue Date*
B&P	Bid and Permit	February 27, 2026
AD02	Addendum 02	March 18, 2026
AD03	Addendum 03	March 18, 2026
AD04	Addendum 04	April 16, 2026
BU01	**Bulletin 01**	**August 20, 2026**

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Not used

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Not used

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02	Cleveland Public Library Experiential Branding Standards, Moody Nolan	00.00.2025
03	**Hazardous Materials Survey, CTL Engineering of Ohio, Inc.**	**June 12, 2025**

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SECTION 00 26 00 - PROCUREMENT SUBSTITUTION PROCEDURES

GENERAL

1.1 DEFINITIONS

A. Procurement Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Procurement and Contracting Documents, submitted prior to receipt of bids.

1. Substitution requests are restricted to the bidding period.

B. Procurement Prior Approval Requests: Requests for approval of products or manufacturers from those required by the Contract Documents as defined by product selection procedures in Section 01 60 00 - Product Requirements.

C. Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Contract Documents, submitted following Contract award. See the General Conditions and Section 01 25 00 - Substitution Procedures for conditions under which Substitution requests will be considered following Contract award.

1. Substitutions for convenience and not permitted.

1.2 QUALITY ASSURANCE

A. Compatibility: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.3 PROCUREMENT SUBSTITUTIONS

A. General: By submitting a bid, the Bidder represents that its bid is based on materials and equipment described in the Procurement and Contracting Documents, including Addenda. Bidders are encouraged to request approval of qualifying substitute materials and equipment when the Specifications Sections list materials and equipment by product or manufacturer name.

B. Procurement Substitution Requests will be received and considered by Owner when the following conditions are satisfied, as determined by Architect; otherwise requests will be returned without action:

1. Extensive revisions to the Contract Documents are not required.

2. Proposed changes are in keeping with the general intent of the Contract Documents, including the level of quality of the Work represented by the requirements therein.

3. The request is fully documented and properly submitted.

1.4 SUBMITTALS

A. Procurement Substitution Request: Submit to Architect. Request must be made in writing by prime contract Bidder, only, in compliance with the following:

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1. Substitution requests must be received no later than ten (10) days before the bid opening.
2. Submittal Format: Submit each written Procurement Substitution Request, using CSI Substitution Request Form 1.5C, a sample of which immediately follows this section.

B. Architect's Action: Architect may request additional information or documentation necessary for evaluation of the Procurement Substitution Request. Architect will notify all Bidders of acceptance of proposed substitute by means of an Addendum to the Procurement and Contracting Documents.

C. Architect's approval of a substitute during bidding does not relieve Contractor of responsibility to submit required shop drawings and to comply with all other requirements of the Contract Documents.

END OF SECTION

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SUBSTITUTION REQUEST
(During the Bidding/Negotiating Phase)

CSI®

PROJECT: _____

SUBSTITUTION REQUEST NUMBER: _____

_____

FROM: _____

TO: _____

DATE: _____

_____

A/E PROJECT NUMBER: _____

RE: _____

CONTRACT FOR: _____

SPECIFICATION TITLE: _____

DESCRIPTION: _____

SECTION: _____ PAGE: _____

ARTICLE/PARAGRAPH: _____

PROPOSED SUBSTITUTION: _____

MANUFACTURER: _____ ADDRESS: _____ PHONE: _____

TRADE NAME: _____ MODEL NO.: _____

Attached data includes product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.
Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

SUBMITTED BY: _____

SIGNED BY: _____

FIRM: _____

ADDRESS: _____

TELEPHONE: _____

A/E's REVIEW AND RECOMMENDATION:

☐ Approve Substitution—Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures.

☐ Approve Substitution as noted—Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures.

☐ Reject Substitution—Use specified materials.

☐ Substitution Request received too late—Use specified materials.

SIGNED BY: DATE:

SUPPORTING DATA ATTACHED: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

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SECTION 00 31 24 - ENVIRONMENTAL ASSESSMENT INFORMATION

PART 1 GENERAL

1.1 ENVIRONMENTAL ASSESSMENT STUDY

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.

B. Certain preliminary investigations and studies made by the Owner are available to the bidders but will not be part of Contract Documents, as follows:

1. Original copy is available for inspection at Owner's offices during normal business hours.

2. **Hazardous Materials Survey report entitled "Hazardous Materials Survey" was performed by CTL Engineering of Ohio, Inc., dated June 12, 2026.**

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 00 31 32 - GEOTECHNICAL DATA

PART 1 GENERAL

1.1 EXISTING CONDITIONS

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information. This Document and its attachments are not part of the Contract Documents.

B. Because subsurface conditions indicated by the soil borings are a sampling in relation to the entire construction area, and for other reasons, the Owner, the Architect, the Architect's consultants, and the firm reporting the subsurface conditions do not warranty the conditions below the depths of the borings or that the strata logged from the borings are necessarily typical of the entire site. Any party using the information described in the soil borings and geotechnical report shall accept full responsibility for its use.

C. Geotechnical Report:

1. Entitled "Geotechnical Engineering Services Report" was performed by Professional Service Industries, Inc. (PSI), dated December 15, 2025.
2. Original copy is attached; refer to Appendix Item 01.
3. This report identifies properties of below grade conditions and offers recommendations for the design of foundations, prepared primarily for the use of Architect.
    a. See report for description of subsurface conditions found on site and recommendation for site preparation and earthwork construction.
    b. See structural drawings for information on foundations required in accordance with the findings and recommendations listed within the geotechnical report.
    c. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.
    d. Any party using information described in the geotechnical report shall make additional test borings and conduct other exploratory operations that may be required to determine the character of subsurface materials that may be encountered.
4. The recommendations described shall not be construed as a requirement of this Contract, unless specifically referenced in Contract Documents.
5. This report, by its nature, cannot reveal all conditions that exist on the site. Should subsurface conditions be found to vary substantially from this report, changes in the design and construction of foundations will be made, with resulting credits or expenditures to the Contract Sum accruing to Owner.

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PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 10 00 - SUMMARY

PART 1 GENERAL

1.1 PROJECT

A. Project Name: Fleet Branch Renovation and Expansion

B. Owner's Name: Cleveland Public Library.

C. Architect's Name: Bialosky.

D. Architect's Consultants:

1. MEP and AV/IT Engineer: Algebra AEC
2. Structural Engineer: Barber & Hoffman
3. Civil Engineer: Halle’s Engineering & Design
4. Landscape Architect: LayerCake

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:

1. The Project consists of the renovation and expansion of an existing single story public library building. Small additions on the building's south and east sides will bring the total building area to 9,234 square foot. The building alteration project includes spaces for collection, reading, study and meeting, administrative offices, and support space. The building is Construction Type IIB and non-sprinklered with the exception of the existing sprinkler system in the mechanical mezzanine. Site renovations include an outdoor gathering space, landscaping, and reworking of an existing on-site surface parking lot of 27 spaces. The project is not pursuing LEED or any green building certifications.

1.3 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract AIA A133–2019, Standard Form of Agreement Between Owner and Construction Manager as Constructor where the basis of payment is the Cost of the Work Plus a Fee with a Guaranteed Maximum Price.

1. Construction Manager for this Project is Project's constructor. The terms "Construction Manager" and "Contractor" are synonymous.

1.4 DESCRIPTION OF ALTERATIONS WORK

A. Scope of demolition and removal work is indicated on drawings and specified in Section 02 41 19.

B. Scope of alterations and addition work is indicated on drawings.

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1.5 OWNER'S PRODUCT PURCHASE CONTRACTS

A. Owner has negotiated Product Purchase contracts with suppliers of material and equipment to be incorporated into the Work. Owner will assign these Product Purchase contracts to Contractor. Include costs for purchasing, receiving, handling, storage if required, and installation of material and equipment in the Contract Sum unless otherwise indicated.

1. Contractor's responsibilities are same as if Contractor had negotiated Product Purchase contracts, including responsibility to renegotiate purchase and to execute final purchasing agreements.

B. Owner's Product Purchase Contracts Information:

1. _____: See Section _____.

a. Purchase Contract Firm and Representative: _____.

b. Product Purchase Contract Scope: _____.

c. Product Purchase Status: _____.

d. Quantity: _____.

e. Other Requirements: _____.

1.6 WORK BY OWNER

A. Cooperate fully with Owner, so work may be carried out smoothly, without interfering with or delaying Work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

B. Concurrent Work: Owner will perform construction operations at Project site. Those operations will be conducted simultaneously with Work under this Contract.

C. Items noted NIC (Not in Contract) will be supplied and installed by Owner before Date of Substantial Completion. Some items include:

1. Movable cabinets.

2. Furnishings.

3. Small equipment.

4. Rugs.

5. Artwork.

6. Computers, servers, technology switches, battery backup, software, etc.

1.7 OWNER-FURNISHED/OWNER-INSTALLED (OFOI) PRODUCTS

A. Owner will supply and install the following:

1. Soap dispensers.

2. Security Cameras.

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1.8 OWNER-FURNISHED/CONTRACTOR-INSTALLED (OFCI) PRODUCTS

A. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:

1. Provide to Contractor Owner-reviewed Product Data, Shop Drawings, and Samples.
2. Provide for delivery of Owner-furnished products to Project site.
3. Upon delivery, inspect, with Contractor present, delivered items.
    a. If Owner-furnished products are damaged, defective, or missing, arrange for replacement.
4. Obtain manufacturer's inspections, service, and warranties.
5. Inform Contractor of earliest available delivery date for Owner-furnished products.

B. Contractor's Responsibilities: The Work includes the following, as applicable:

1. Designate delivery dates of Owner-furnished products in Contractor's construction schedule, utilizing Owner-furnished earliest available delivery dates.
2. Review Owner-reviewed Product Data, Shop Drawings, and Samples, noting discrepancies and other issues in providing for Owner-furnished products in the Work.
3. Receive, unload, handle, store, protect, and install Owner-furnished products.
4. Make building services connections for Owner-furnished products.
5. Protect Owner-furnished products from damage during storage, handling, and installation and prior to Substantial Completion.
6. Repair or replace Owner-furnished products damaged following receipt.

C. Owner-Furnished/Contractor-Installed (OFCI) Products:

1. Custodial Cleaning Supplies.
2. Wi-Fi Access Points.

1.9 CONTRACTOR-FURNISHED/OWNER-INSTALLED (CFOI) PRODUCTS

A. Contractor shall furnish products indicated. The Work includes unloading, handling, storing, and protecting Contractor-furnished products as directed and turning them over to Owner at Project closeout.

1.10 OWNER OCCUPANCY

A. Owner intends to occupy the Project upon Substantial Completion.

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

1.11 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Contractor shall have full use of Project site and premises for construction operations during construction period.

1. Locate and conduct construction activities in ways that will limit disturbance to site.

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B. Arrange use of site and premises to allow:

1. Work by Others.

2. Work by Owner.

C. Provide access to and from site as required by law and by Owner:

1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.

2. Do not obstruct roadways, sidewalks, or other public ways without permit.

D. Utility Outages and Shutdown:

1. Prevent accidental disruption of utility services to other facilities.

E. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and controlled substances is not permitted on Owner's property.

1.12 DOCUMENTS APPLICABLE TO EVERY TRADE AND SUB-CONTRACT

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and all provisions of Division 01 sections apply to every trade and sub-contract.

1.13 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. 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.

2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.

3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.

4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.

C. Division 01 General Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

D. 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:

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1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.
3. Keynoting: Materials and products are identified by terminology keynotes referencing specific products found in Specification Sections contained in this Project Manual.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 20 00 - PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

1.2 RELATED REQUIREMENTS

A. Section 01 22 00 - Unit Prices: Monetary values of unit prices; Payment and modification procedures relating to unit prices.

B. Section 01 78 00 - Closeout Submittals: Project record documents.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Use Schedule of Values Form: AIA G703, edition stipulated in the Agreement.

B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.

C. Forms filled out by hand will not be accepted.

D. Submit Schedule of Values at earliest possible date, but no later than 14 days before date of initial Applications for Payment.

E. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section. Identify site mobilization and bonds and insurance.

F. Revise schedule to list approved Change Orders, with each Application For Payment.

1.5 APPLICATIONS FOR PROGRESS PAYMENTS

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

1. Pencil Copy: Submit draft copy 7 calendar days prior to due date.

B. Use Form AIA G702 and Form AIA G703, edition stipulated in the Agreement.

C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.

D. Forms filled out by hand will not be accepted.

E. Execute certification by signature of authorized officer.

F. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.

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G. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.

H. Submit one electronic copy of each Application for Payment.

I. Include the following with the application:

1. Transmittal letter as specified for submittals in Section 01 30 00.
2. Construction progress schedule, revised and current as specified in Section 01 30 00.
3. Partial release of liens from major subcontractors and vendors.
4. Affidavits attesting to off-site stored products.

J. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.6 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:

1. All closeout procedures specified in Section 01 70 00.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 22 00 - UNIT PRICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. List of unit prices, for use in preparing Bids.

B. Measurement and payment criteria applicable to Work performed under a unit price payment method.

C. Defect assessment and non-payment for rejected work.

1.2 RELATED REQUIREMENTS

A. Section 01 20 00 - Price and Payment Procedures: Additional payment and modification procedures.

B. Section 04 01 00 - Maintenance of Masonry.

1.3 DEFINITIONS

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

1.4 COSTS INCLUDED

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

1.5 UNIT QUANTITIES SPECIFIED

A. Quantities indicated in the Contract Documents are for bidding and contract purposes only. Quantities and measurements of actual Work will determine the payment amount.

1.6 MEASUREMENT OF QUANTITIES

A. Measurement methods delineated in the individual specification sections complement the criteria of this section. In the event of conflict, the requirements of the individual specification section govern.

B. Take all measurements and compute quantities. Measurements and quantities will be verified by Owner.

1. 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.

C. Assist by providing necessary equipment, workers, and survey personnel as required.

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D. Measurement by Area: Measured by square dimension using mean length and width or radius.

E. Linear Measurement: Measured by linear dimension, at the item centerline or mean chord.

F. Stipulated Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as a completed item or unit of the Work.

1.7 PAYMENT

A. Payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities of Work that is incorporated in or made necessary by the Work and accepted by the Architect, multiplied by the unit price.

B. Payment will not be made for any of the following:

1. Products wasted or disposed of in a manner that is not acceptable.
2. Products determined as unacceptable before or after placement.
3. Products not completely unloaded from the transporting vehicle.
4. Products placed beyond the lines and levels of the required Work.
5. Products remaining on hand after completion of the Work.
6. Loading, hauling, and disposing of rejected Products.

1.8 DEFECT ASSESSMENT

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

B. If, in the opinion of Owner, it is not practical to remove and replace the Work, Owner will direct one of the following remedies:

1. The defective Work may remain, but the unit price will be adjusted to a new unit price at the discretion of Owner.
2. The defective Work will be partially repaired to the instructions of the Owner, and the unit price will be adjusted to a new unit price at the discretion of Owner.

C. The individual specification sections may modify these options or may identify a specific formula or percentage price reduction.

D. The authority of Owner to assess the defect and identify payment adjustment is final.

1.9 SCHEDULE OF UNIT PRICES

A. Unit Price No. 1; Brick Repointing

1. Description: Work of repointing brick veneer portions of existing exterior building facade, as described in Section 04 01 00 - Maintenance of Masonry.
2. Unit of Measurement: Cost per each 25 square foot.

B. Unit Price No. 2; Relocate Water Supply Line

1. Description: Work of relocating existing below-grade domestic water supply piping that interferes with constructing the addition to the building.

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2. Unit of Measurement: Cost per each linear foot of water line relocated.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 23 00 - ALTERNATES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Description of Alternates.

B. Procedures for pricing Alternates.

C. Documentation of changes to Contract Sum and Contract Time.

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 the Owner decides to accept a corresponding change in the amount of construction to be completed and/or in the products, materials, equipment, systems, and/or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if accepted by the Owner and 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 alternates into the Work. No other adjustments are made to the Contract Sum.

1.3 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work and modify surrounding work to completely integrate the Work of each 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. Execute accepted alternates under the same conditions as other Work of the Contract.

C. Schedule of Alternates: Drawings and Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

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1.5 SCHEDULE OF ALTERNATES

A. Alternate No. A-1 - Standing Seam Material MTL-1:

1. Scope: Standing seam metal roofing, standing seam metal wall cladding, all related sheet metal flashing, trim, roof edge metal, and drainage accessories indicated as MTL-1 on drawings and specified in the following Sections:

a. 07 61 13 - Standing Seam Sheet Metal Roofing and Wall Cladding

b. 07 62 00 - Sheet Metal Flashing and Trim

c. 07 71 00 - Roof Specialties

d. 07 71 23 - Manufactured Gutters and Downspouts

e. 07 72 00 - Roof Accessories

2. Base Bid Item: Provide zinc sheet, prefinished; specified in Section 07 61 13.

3. Alternate Item: Provide aluminum sheet, specified in Section 07 61 13, prefinished as follows:

a. Finish: Superior performing organic coating complying with Section 05 05 13 - Shop-Applied Coatings for Metal.

b. Color: ATAS Premium Finish, Antique Patina (24)

B. Alternate No. A-2 - Cleaning of Exterior Face Brick Masonry:

1. Base Bid Item: Provide chemical cleaning of all existing interior face brick. Repoint existing exterior face brick where deterioration is evident.

2. Alternate Item: In addition to base bid items; provide chemical cleaning of all exterior face brick masonry surfaces. Refer to Section 04 01 00 - Maintenance of Masonry.

C. Alternate No. E-1 - Electric Vehicle Chargers:

1. Base Bid Item: Provide electric vehicle charging stations, including pathway, wire, concrete base, and circuit, at location indicated on drawings.

a. Charging ~~**stations are**~~ **station is** to be Level 2 electric vehicle supply equipment (EVSE). The EVSE power shall be fed from the new panelboard in the janitor's closet, ~~**each**~~ with a ~~**60A/2**~~ **40A/2** breaker.

b. Work includes site demolition, trenching, and replacement of asphalt parking lot and concrete sidewalk as shown on civil drawings, refer to C-200.

2. Alternate Item: No work.

D. Alternate No. M-1 - Heating Plant:

1. Alternate M-1 includes the replacement of the existing two boilers at the Fleet branch with two larger boilers.

2. The BOD shall be Lochinvar, FTXL™ Fire Tube Boiler, 399 MBH.

3. Contractor shall include a new recirculation pump for each boiler as well as two new primary pumps.

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4. Contractor shall include a new air / dirt separator, expansion tank, and associated piping required to install the new heating plant.
5. Include new combustion and flue piping for the two boilers which is 6" plastic piping. up through the roof with a termination kit on the roof.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Procedural requirements for substitutions.

1.2 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittal procedures, coordination.

B. Section 01 60 00 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

1.3 DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.

1. Substitutions for Cause: Owner will consider requests for substitution, during the construction period, proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms, and other changed Project circumstances beyond Contractor's control.

2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer substantial advantage to the Project.

a. Substitution requests offering advantages solely to the Contractor will not be considered.

1.4 REFERENCE STANDARDS

A. CSI/CSC Form 1.5C - Substitution Request (During the Bidding/Negotiating Stage); Current Edition.

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

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:

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1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
2. Agrees to provide the same warranty for the substitution as for the specified product.
3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
5. Waives claims for additional costs or time extension that may subsequently become apparent.
6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
   1. Note explicitly any non-compliant characteristics.

C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
   1. Forms indicated and included in the Project Manual are adequate for this purpose, and must be used.

D. Limit each request to a single proposed substitution item.
   1. Submit an electronic document, combining the request form with supporting data into single document.

3.2 SUBSTITUTION PROCEDURES DURING PROCUREMENT

A. See Section 00 26 00 - Procurement Substitution Procedures for complete requirements.

B. Submittal Time Restrictions:
   1. Owner will consider requests for substitutions only if submitted at least 10 days prior to the date for receipt of bids.

C. Submittal Form (before award of contract):
   1. Submit substitution requests by completing CSI/CSC Form 1.5C - Substitution Request. See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.

3.3 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Submittal Form (after award of contract):
   1. Submit substitution requests by completing CSI/CSC Form 13.1A - Substitution Request (After Bidding/Negotiating), a sample of which immediately follows this section. See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.

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B. Submit request for Substitution for Cause immediately upon the 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.

1. Architect will consider Contractor's request for substitution only when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results

b. Substitution request is fully documented and properly submitted.

c. Requested substitution will not adversely affect Contractor's construction schedule.

d. Requested substitution has received necessary approvals of authorities having jurisdiction.

e. Requested substitution is compatible with other portions of the Work.

f. Requested substitution has been coordinated with other portions of the Work.

g. Requested substitution provides specified warranty.

h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

C. Substitution for Convenience: Not permitted.

D. Substitutions will **not** be considered under one or more of the following circumstances:

1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.

2. Without a separate written request.

3. When acceptance will require revisions to Contract Documents.

3.4 RESOLUTION

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

B. Architect will notify Contractor in writing of decision to accept or reject request.

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

3.5 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.

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3.6 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. Include completed Substitution Request Forms as part of the Project record.

END OF SECTION

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SUBSTITUTION REQUEST
(After the Bidding/Negotiating Phase)

PROJECT: _____

SUBSTITUTION REQUEST NUMBER: _____

_____ FROM: _____

TO: _____ DATE: _____

_____ A/E PROJECT NUMBER: _____

RE: _____ CONTRACT FOR: _____

SPECIFICATION TITLE: _____ DESCRIPTION: _____

SECTION: _____ PAGE: _____ ARTICLE/PARAGRAPH: _____

PROPOSED SUBSTITUTION: _____

MANUFACTURER: _____ ADDRESS: _____ PHONE: _____

TRADE NAME: _____ MODEL NO.: _____

INTALLER: _____ ADDRESS: _____ PHONE: _____

HISTORY: ☐ New Product ☐ 1-4 years old ☐ 5-10 years old ☐ More than 10 years old

DIFFERENCES BETWEEN PROPOSED SUBSTITUTION AND SPECIFIED PRODUCT: _____

_____

_____

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

REASON FOR NOT PROVIDING SPECIFIED ITEM: _____

_____

SIMILAR INSTALLATION:

PROJECT: _____ ARCHITECT: _____

ADDRESS: _____ OWNER: _____

_____ DATE INSTALLED: _____

PROPOSED SUBSTITUTION AFFECTS OTHER PARTS OF WORK: ☐ No ☐ Yes; explain _____

_____

SAVINGS TO OWNER FOR ACCEPTING SUBSTITUTION:

PROPOSED SUBSTITUTION CHANGES CONTRACT TIME: ☐ No ☐ Yes [Add] [Deduct] _____ days.

SUPPORTING DATA ATTACHED: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

CONTINUE ON NEXT PAGE

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SUBSTITUTION REQUEST
(After the Bidding/Negotiating Phase—Continued)

The Undersigned certifies:
- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

SUBMITTED BY: _____

SIGNED BY: _____

FIRM: _____

ADDRESS: _____

TELEPHONE: _____

☐ **Attachments**

A/E's REVIEW AND RECOMMENDATION:

☐ Approve Substitution—Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures.

☐ Approve Substitution as noted—Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures.

☐ Reject Substitution—Use specified materials.

☐ Substitution Request received too late—Use specified materials.

SIGNED BY: **DATE:**

OWNER'S REVIEW AND ACTION:

☐ Substitution approved—Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures. Prepare Change Order

☐ Substitution approved as noted—Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures. Prepare Change Order.

☐ Substitution rejected—Use specified materials.

SIGNED BY: **DATE:**

ADDITIONAL COMMENTS: ☐ **Contractor** ☐ **Subcontractor** ☐ **Supplier** ☐ **Manufacturer** ☐ **A/E**

CSI Form 13.1A (April 2022 version)

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SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Procedures for handling and processing Contract modifications, including the following:

1. Minor changes in the Work
2. Proposal requests, pre-change order.
3. Change order procedures.
4. Construction change directive.

1.2 RELATED REQUIREMENTS

A. Section 00 63 53 - Request for Proposal Form: Required form for Contractor-initiated proposal requests made after award of contract (during construction).

B. Section 01 78 00 - Closeout Submittals: Project record documents.

1.3 MODIFICATION PROCEDURES

A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to Contract Documents.

1.4 MINOR CHANGES IN THE WORK

A. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue supplemental instructions directly to Contractor, using "Architect's Supplemental Instructions" AIA G710.

1.5 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

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c. Include costs of labor and supervision directly attributable to the change.

d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

1. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

2. Include a statement outlining 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 the Contract Time.

3. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.

4. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

5. Include costs of labor and supervision directly attributable to the change.

6. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

7. Comply with requirements in Section 01 25 00 - Substitution Procedures if the proposed change requires substitution of one product or system for product or system specified.

C. Proposal Request Form: Sample copies are included in Project Manual.

1. Submit proposal requests by completing 00 63 53 - Request for Proposal Form. See this form for additional information and instructions. Use only this document; other forms of submission are unacceptable.

1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA G701.

1.7 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

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B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 30 00 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General administrative requirements.

B. Preconstruction meeting.

C. Site mobilization meeting.

D. Progress meetings.

E. Construction progress schedule.

F. Submittals for review, information, and project closeout.

G. Number of copies of submittals.

H. Requests for Interpretation (RFI) procedures.

I. Submittal procedures.

1.2 RELATED REQUIREMENTS

A. Section 00 63 13 - Request for Information (RFI) Form.

B. Section 01 31 13 - Project Coordination: Coordination drawings; general coordination requirements and procedures.

C. Section 01 40 00 - Quality Requirements: General quality assurance and quality control requirements.

D. Section 01 60 00 - Product Requirements: General product requirements.

E. Section 01 70 00 - Execution and Closeout Requirements: Additional coordination requirements.

F. Section 01 78 00 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.3 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 01 70 00 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

B. Make the following types of submittals to Architect:

1. Requests for Interpretation (RFI).
2. Requests for substitution.
3. Shop drawings, product data, and samples.
4. Test and inspection reports.
5. Design data.

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6. Manufacturer's instructions and field reports.
7. Applications for payment and change order requests.
8. Progress schedules.
9. Correction Punch List and Final Correction Punch List for Substantial Completion.
10. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PROJECT MEETINGS - GENERAL

A. Schedule and conduct meetings 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 a minimum of seven (7) days prior to meeting.
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 within three (3) days of the meeting.

3.2 PRECONSTRUCTION MEETING

A. Schedule meeting after Notice of Award.

B. Attendance Required:

1. Owner.
2. Architect.
3. Contractor.
4. Major Subcontractors.

C. Agenda:

1. Execution of Owner-Contractor Agreement.
2. Submission of executed bonds and insurance certificates.
3. Distribution of Contract Documents.
4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
5. Designation of personnel representing the parties to Contract.
6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
7. Scheduling.

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D. Record minutes and distribute electronically within three (3) days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.3 SITE MOBILIZATION MEETING

A. Schedule meeting at the Project site prior to Contractor occupancy.

B. Attendance Required:

1. Contractor.
2. Owner.
3. Architect.
4. Contractor's superintendent.
5. Major subcontractors.

C. Agenda: Discuss items of significance that could affect progress, including the following:

1. Use of premises by Owner and Contractor.
2. Owner's requirements.
3. Construction facilities and controls provided by Owner.
4. Temporary utilities provided by Owner.
5. Survey and building layout.
6. Security and housekeeping procedures.
7. Schedules.
8. Application for payment procedures.
9. Procedures for testing.
10. Procedures for maintaining record documents.
11. Requirements for start-up of equipment.
12. Inspection and acceptance of equipment put into service during construction period.

D. Record minutes and distribute electronically within three (3) days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.4 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at weekly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:

1. Contractor.
2. Owner.

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3. Architect.
4. Contractor's superintendent.
5. Major subcontractors.

D. Agenda: Discuss items of significance that could affect progress, including the following:

1. Review minutes of previous meetings.
2. Review of work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review and resolution of BIM component conflicts.
6. Review of submittals schedule and status of submittals.
7. Review of RFIs log and status of responses.
8. Review of off-site fabrication and delivery schedules.
9. Maintenance of progress schedule.
10. Corrective measures to regain projected schedules.
11. Planned progress during succeeding work period.
12. Coordination of projected progress.
13. Maintenance of quality and work standards.
14. Effect of proposed changes on progress schedule and coordination.
15. Other business relating to work.

E. Record minutes and distribute electronically within three (3) days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.5 CONSTRUCTION PROGRESS SCHEDULE

A. Within 10 days after date established in Notice to Proceed, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.

1. Include written certification that major Subcontractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

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3.6 COORDINATION DRAWINGS - SEE SECTION 01 31 13

3.7 REQUESTS FOR INTERPRETATION (RFI)

A. Definition: A request seeking one of the following:

1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.

2. A resolution to an issue which has arisen due to field conditions and affects design intent.

B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.

1. Prepare a separate RFI for each specific item.

a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.

b. Do not forward requests which solely require internal coordination between subcontractors.

2. See Section 00 63 13 - Request for Information (RFI) Form.

3. Combine RFI and its attachments into a single electronic file. PDF format is preferred.

D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.

1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.

2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::

a. Approval of submittals (use procedures specified elsewhere in this section).

b. Approval of substitutions (see Section - 01 60 00 - Product Requirements)

c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).

d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).

3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response.

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4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response.
    a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.

E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
1. Official Project name and number, and any additional required identifiers established in Contract Documents.
2. Owner's, Architect's, and Contractor's names.
3. Discrete and consecutive RFI number, and descriptive subject/title.
4. Issue date, and requested reply date.
    a. Do not request Architect's reply within a shorter period than that indicated in "RFI Review Time" paragraph below.
5. Reference to particular Contract Document(s) requiring additional information or additional interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
1. Indicate current status of every RFI. Update log promptly and on a regular basis.
2. Note dates of when each request is made, and when a response is received.
3. Highlight items requiring priority or expedited response.
4. Highlight items for which a timely response has not been received to date.
5. Remove improper or frivolous RFIs.

H. RFI Review Time: Architect will respond and return RFIs to Contractor, according to priority level, within the time indicated from the day of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
1. Prioritized Response Time:

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a. Critical Items: Three (3) working days.

b. Standard Items: Five (5) working days.

c. Non-Critical Items: Seven (7) working days.

2. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

3. If Architect's response includes a request for additional information, then the Architect's review time will date from time of receipt of additional information.

I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.

1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.

2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.

3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.

4. Notify Architect within five (5) calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.8 SUBMITTAL SCHEDULE

A. Submittal Schedule - General: Submittal Schedule is required.

1. List all submittals in chronological order by dates required by the construction schedule.

2. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates.

3. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

4. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.

B. Submit to Architect for review a schedule for submittals in tabular format.

1. Submit at the same time as the preliminary schedule.

2. Coordinate with Contractor's construction schedule and schedule of values.

3. Format schedule to allow tracking of status of submittals throughout duration of construction.

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4. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
    a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.
    b. Do not request Architect's reply within a shorter period than that indicated in "Action Submittal Review Time" paragraph below.

3.9 SUBMITTALS FOR REVIEW (ACTION SUBMITTALS)

A. When the following are specified in individual sections, submit them for review:
    1. Product data.
    2. Shop drawings.
    3. Samples for selection.
    4. Samples for verification.
B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
C. Samples will be reviewed for aesthetic, color, or finish selection.
D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 - Closeout Submittals.

3.10 SUBMITTALS FOR INFORMATION (INFORMATION SUBMITTALS)

A. When the following are specified in individual sections, submit them for information:
    1. Design data.
    2. Sustainability design submittals and reports (if applicable).
    3. Certificates.
    4. Test reports.
    5. Inspection reports.
    6. Manufacturer's instructions.
    7. Manufacturer's field reports.
    8. Field engineering daily reports.
    9. Other types indicated.
B. Submit for Architect's knowledge as contract administrator or for Owner.

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3.11 SUBMITTALS FOR PROJECT CLOSEOUT (CLOSEOUT SUBMITTALS)

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:

1. Project record documents.
2. Operation and maintenance data.
3. Warranties.
4. Bonds.
5. Maintenance materials (attic stock).
6. Other types as indicated.

D. Submit for Owner's benefit during and after project completion.

3.12 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.

1. After review, produce duplicates.
2. Retained samples will not be returned to Contractor unless specifically so stated in individual specification sections.

3.13 SUBMITTAL PROCEDURES

A. General Requirements:

1. Use a single transmittal for related items.
2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
3. Transmit using approved form.
    a. Use Contractor's form, subject to prior approval by Architect.
4. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
5. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
6. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.

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a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.

7. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
   a. Send submittals in electronic format via email to Architect.
8. Action Submittal Review Time: Schedule submittals to expedite the Project, and coordinate submission of related items.
   a. For each submittal for review, allow the indicated number of days excluding delivery time to and from the Contractor.
      1) Prioritized Response Time:
         (a) Critical Items: Seven (7) working days.
         (b) Standard Items: Ten (10) working days.
         (c) Non-Critical Items: Fifteen (15) working days.
   b. Concurrent Consultant Review: Submittals may be transmitted simultaneously to Architect and to Architect's consultants, Owner, or another affected party; allow an additional five (5) days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
   c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 days.
   d. If Architect's response includes a request for additional information, then the Architect's review time will date from time of receipt of additional information.
9. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
10. Provide space for Contractor and Architect review stamps.
11. When revised for resubmission, identify all changes made since previous submission.
12. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
13. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
14. Submittals not requested will be recognized, and will be returned "Not Reviewed",

B. Product Data Procedures:
   1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each submittal to show which products and options are applicable.
   3. Submit only information required by individual specification sections; include the following information, as applicable:
      a. Manufacturer's catalog cuts.

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b. Manufacturer's product specifications.

c. Standard color charts.

d. Statement of compliance with specified referenced standards.

e. Testing by recognized testing agency.

f. Application of testing agency labels and seals.

g. Notation of coordination requirements.

h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

a. Wiring diagrams that show factory-installed wiring.

b. Printed performance curves.

c. Operational range diagrams.

d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Collect required information into a single submittal.

6. Submit concurrently with related shop drawing submittal.

7. Do not submit (Material) Safety Data Sheets for materials or products.

8. Submit sustainable design reporting submittals (if any) under separate cover.

C. Shop Drawing Procedures:

1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.

2. Fully illustrate project-specific information and requirements in the Contract Documents; include the following information, as applicable:

a. Identification of products.

b. Schedules.

c. Compliance with specified standards.

d. Notation of coordination requirements.

e. Notation of dimensions established by field measurement.

f. Relationship and attachment to adjoining construction clearly indicated.

g. Seal and signature of professional engineer if specified.

3. Do not reproduce Contract Documents to create shop drawings.

4. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

D. Samples Procedures:

1. Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.

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2. Transmit related items, such as accessories, together as single package.
3. Identify each item to allow review for applicability in relation to shop drawings showing installation locations. Permanently attach label on unexposed side of Samples that includes the following:
    a. Project name and submittal number.
    b. Generic description of Sample.
    c. Product name and name of manufacturer.
    d. Sample source.
    e. Number and title of applicable Specification Section.
    f. Specification paragraph number and generic name of each item.
4. Include with transmittal high-resolution image files of samples to facilitate electronic review and approval. Provide separate submittal page for each item image.
5. Samples for Selection: Submit manufacturer's color charts consisting of units or sections of units, showing the full range of colors, textures, and patterns available.
6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.

F. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

G. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

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H. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.

1. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
2. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
3. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
4. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
5. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Include names of firms and personnel certified.

I. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.

J. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

K. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

L. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

M. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

N. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.

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3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

3.14 CONTRACTOR'S PROFESSIONAL DESIGN SERVICES

A. See Section 01 40 00 - Quality Requirements for additional professional design services' requirements.

B. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

C. Delegated Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file cop of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

3.15 CONTRACTOR'S REVIEW

A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Architect will not review submittals received from Contractor that do not have Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.16 ARCHITECT'S SUBMITTAL REVIEW

A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.

B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.

1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.

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D. Action Submittals: Architect's and consultants' actions on items submitted for review.
    1. Authorizing purchasing, fabrication, delivery, and installation:
        a. "Approved for Design".
        b. "Approved as Noted for Fabrication".
            1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
    2. Not Authorizing fabrication, delivery, and installation:
        a. "Revise and Resubmit".
            1) Resubmit revised item, with review notations acknowledged and incorporated.
            2) Non-responsive resubmittals may be rejected.
        b. "Not Approved".
            1) Submit item complying with requirements of Contract Documents.
E. Information Submittals: Architect's and consultants' actions on items submitted for information.
    1. Items for which no action was taken:
        a. "Receipt Acknowledged, No Action Taken" - to notify the Contractor that the submittal has been received for record only.

END OF SECTION

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SECTION 01 31 13 - PROJECT COORDINATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General coordination procedures.

B. Coordination drawings.

C. Coordination documents.

D. Coordination of submittals.

E. Coordination of substitutions and modifications.

1.2 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Additional requirements for coordination.

B. "Agreement for Transfer and Use of Electronic Files" attached to this section.

1.3 SUBMITTALS

A. Submit coordination drawings and schedules prior to submitting shop drawings, product data, and samples.

1.4 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results, where installation of one part of the Work depends on installation of other components, before or after its own installation.

2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.

3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.

2. Preparation of the schedule of values.

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3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

1.5 COORDINATION DRAWINGS

A. Definition: Coordination Drawings are drawings that show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or function as intended.

1. Provide composite drawings showing work that is exposed and/or where there are hung ceilings for integration of all the Work including work shown in detail on shop drawings or product data. Coordination Drawings are not considered shop drawings and must be definitive in nature.
2. Refer to Mechanical, Plumbing, and Electrical Specification Sections for additional general requirements applicable to the Work.

B. Coordination: General Contractor or Construction Manager shall coordinate preparation of Coordination Drawings with all subcontractors. Composite Coordination Drawings shall be prepared electronically for installation of products and materials which are to be fabricated off-site by separate entities and where limited space availability necessitates maximum utilization of space for efficient installation of different components.

1. Drawings shall show dimensional plan and elevation locations of mechanical and electrical work, as well as cross and longitudinal sections and large scale details as required to fully delineate all conditions. Composite drawings shall be prepared by competent draftspersons, in a clear, legible manner.
2. HVAC subcontractor shall prepare layout drawings of HVAC ductwork and piping, at not less than 1/4 inch scale, including locations of registers, grilles, diffusers and similar features, as well as valves, dampers, and other items requiring access for service or maintenance. HVAC subcontractor shall transmit the electronic drawing files and one reproducible to the Electrical subcontractor.
3. Electrical subcontractor shall locate on the drawings his own routings of conduit as well as other items such as lighting fixtures, access panels, switch panels, etc. as required to determine inter-relationships and possible interferences with HVAC work and architectural or structural features. The electronic drawings shall then be sent to the plumbing and fire protection subcontractors.
4. Plumbing and Fire Protection subcontractors shall locate on the drawings their own routings as well as other items such as valves, access panels, etc. as required to determine inter-relationships and possible interferences with HVAC and Electrical work and architectural or structural features. The electronic drawings shall then be sent to the Construction Manager.

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5. Minor changes in duct, pipe or conduit routings that do not affect the intended function may be made as required to avoid space conflicts, when mutually agreed upon, but items may not be resized, exposed or relocated without Architect's approval. Changes shall not be made in wall locations or openings, or other features affecting the function or aesthetics of the building.
6. After conflicts and/or interferences are resolved, General Contractor or Construction Manager shall develop and submit to Architect composite drawings showing the agreed upon routings, layouts, and juxtapositions of ductwork, fire protection, piping, major conduits, valves, panels, lighting fixtures and all other major mechanical and electrical items of work including sequence of installation. General Contractor or Construction Manager and each subcontractor shall sign the composite drawings and in signing certify their awareness of, and agreement with, the indicated routings, layouts, and sequencing and their inter-relationship with Work of all portions of the Contract.
7. No extra compensation will be allowed for relocating any duct, pipe, conduit or other material that has been installed without proper coordination between the General Contractor or Construction Manager and subcontractors involved. No extra cost will be incurred by the Owner based on coordination drawing requirements. Unauthorized deviations in the actual construction will not be permitted. Unauthorized work will be subject to removal and correction at no additional cost to the Owner.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 COORDINATION REQUIRED

A. Coordinate progress schedules, including dates for submittals and for delivery of products.

B. Conduct meetings among subcontractors and others concerned, to establish and maintain coordination and schedules, and to resolve coordination matters in dispute.

C. Participate in progress meetings. Report on progress of work to be adjusted under coordination requirements, and any required changes in schedules. Transmit minutes of meetings and reports to concerned parties.

3.2 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Drawings generated independently of the contract documents is REQUIRED for the following trades:
    a. Steel
    b. Mechanical

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c. Electrical

d. Plumbing

2. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.

b. Coordinate the addition of trade-specific information to coordination drawings in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.

c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.

d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.

e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.

f. Indicate required installation sequences.

g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.

a. Use of MEP drawing background is acceptable.

2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.

3. Mechanical Rooms: Provide coordination drawings for mechanical rooms, showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.

4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.

5. Slab Embedded Items: Indicate sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.

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a. Slab edges, depressions, and locations are part of the contract documents.

6. Mechanical and Plumbing Work: Show the following:
   a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
   b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
   c. Fire-rated enclosures around ductwork.
7. Electrical Work: Show the following:
   a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
   b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
   c. Panel board, switchboard, switchgear, transformer, busway, generator, and motor-control center locations.
   d. Location of pull boxes and junction boxes, dimensioned from column center lines.
8. Fire-Protection System: Show locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
9. Review: Architect will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.

C. Coordination Drawing Process: Prepare coordination drawings in the following manner:
1. Schedule submittal and review of Fire Sprinkler, Plumbing, HVAC, and Electrical Shop Drawings to make required changes prior to preparation of coordination drawings.
2. Commence routing of coordination drawing files with HVAC Installer, who will provide drawing plan files denoting approved ductwork. HVAC Installer will locate ductwork and piping on a single layer, using orange color. Forward drawings to Plumbing Installer.
3. Plumbing Installer will locate plumbing and equipment on a single layer, using blue color.
4. Fire Sprinkler Installer will locate piping and equipment, using red color. Fire Sprinkler Installer shall forward drawing files to Electrical Installer.
5. Electrical Installer will indicate service and feeder conduit runs and equipment in green color. Electrical Installer shall forward drawing files to Communications and Electronic Safety and Security Installer.
6. Communications and Electronic Safety and Security Installer will indicate cable trays and cabling runs and equipment in purple color. Communications and Electronic Safety and Security Installer shall forward completed drawing files to Contractor.
7. Contractor shall perform the final coordination review. As each coordination drawing is completed, Contractor will meet with Architect to review and resolve conflicts on the coordination drawings.

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D. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
2. File Submittal Format: Submit or post coordination drawing files using PDF format.
3. BIM File Incorporation: Develop and incorporate coordination drawing files into BIM established for Project.
    a. Perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.
4. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
    a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
    b. Contractor shall execute a data licensing agreement in the form of Agreement included in this Project Manual.
        1) Refer to "Agreement for Transfer and Use of Electronic Files" attached to this section.

3.3 COORDINATION DOCUMENTS

A. Prepare a master schedule identifying responsibilities for activities that directly relate to this work, including submittals and temporary utilities; organize by specification section.

B. Identify electrical power characteristics and control wiring required for each item of equipment.

C. Maintain documents for the duration of the work, recording changes due to site instructions, modifications or adjustments.

D. Reproduce and distribute copies to concerned parties.

3.4 COORDINATION OF SUBMITTALS

A. Review shop drawings, product data, and samples for compliance with Contract Documents and for coordination with related work. Transmit copies of reviewed documents to Architect.

B. Check field dimensions and clearances and relationship to available space and anchors.

C. Check compatibility with equipment and work of other sections, electrical characteristics, and operational control requirements.

D. Check motor voltages and control characteristics.

E. Coordinate controls, interlocks, wiring of switches, and relays.

F. Coordinate wiring and control diagrams.

G. When changes in the work are made, review their effect on other work.

H. Verify information and coordinate maintenance of record documents.

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3.5 COORDINATION OF SUBSTITUTIONS AND MODIFICATIONS

A. Review proposals and requests for substitution prior to submission to Architect.

B. Verify compliance with Contract Documents and for compatibility with work of other sections.

C. Submit with recommendation for action.

END OF SECTION

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BIALOSKY
CLEVELAND

6555 Carnegie Ave.
Cleveland, OH 44103

P 216 752 8750

AGREEMENT FOR TRANSFER AND USE OF ELECTRONIC FILES

BY ACTION OF ACCEPTING ONE OR MORE ELECTRONIC FILES FROM BIALOSKY + PARTNERS ARCHITECTS LLC, THIS AGREEMENT IS ACCEPTED BETWEEN BIALOSKY + PARTNERS ARCHITECTS LLC AND THE PARTY PERFORMING THE SAID ACTION. This agreement is by and between Bialosky + Partners Architects LLC, 6555 Carnegie Avenue, Cleveland, OH 44103 and the Architect's consultants (hereinafter "BPA"), and the Contractor and Contractor's agents accepting the electronic files (hereinafter "Contractor").

Whereas the Contractor has requested BPA to provide electronic files for the Contractor's convenience and use and whereas BPA is willing to accommodate this request pursuant to the following terms and conditions, the Contractor and BPA agree as follows:

BPA and Contractor fully understand that the data contained in these electronic files are part of BPA's Instruments of Service, BPA shall be deemed the author of the drawings and data, and BPA shall retain all common law, statutory law and other rights, including copyrights. These files are not a product, and shall not be used by the Contractor or anyone else receiving this data through or from the Contractor for any other purpose, other than as a convenience in the preparation of project related drawings for a specific project in which BPA is involved. BPA makes no warranties, either express or implied, of merchantability and fitness for any particular purpose.

The Contractor understands and accepts that electronic files deteriorate or can be modified inadvertently or otherwise without authorization by BPA. Therefore, BPA may remove all indication of its ownership or involvement from these electronic files. Furthermore, BPA makes no representations as to compatibility, usability or readability of the files resulting from the use of software, application packages, operating systems, or computer hardware differing from those of BPA. The Contractor understands that these electronic files are not contract documents. Significant differences may exist between these electronic files and corresponding hard copy documents due to addenda, change orders, revisions, layer visibility or other reasons. BPA makes no representations as to the accuracy or completeness of these electronic files. The printed/hard sealed copies of the construction documents are the only documents that may be relied upon, and the documents transmitted electronically are not to be construed as contract documents. Contractor understands and agrees that Contractor alone is completely responsible, without limitation, to check and otherwise confirm accuracy of all data on these electronic files.

The Contractor agrees to make no claims and hereby waives any claims or causes of action of any nature whatsoever against BPA, its officers, directors, employees, agents, clients, or sub-consultants which may arise out of or in connection with the use of the electronic files. Furthermore, Contractor shall indemnify, defend and hold harmless BPA, its officers, directors, employees, agents, clients, or sub-consultants from and against any and all claims, damages, losses and expenses, including attorney fees, arising out of or related to the use of the electronic files by the Contractor, or by anyone else receiving this data through or from the Contractor.

_____	_____	_____
Authorized Contractor Representative	Company	Date

End of Agreement

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BIALOSKY
CLEVELAND

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Cleveland, OH 44103

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_____	_____	_____
Authorized Contractor Representative	Company	Date

End of Agreement

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SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submittals.

B. Quality assurance.

C. References and standards.

D. Testing and inspection agencies and services.

E. Contractor's construction-related professional design services.

F. Contractor's design-related professional design services.

G. Control of installation.

H. Mock-ups.

I. Tolerances.

J. Manufacturers' field services.

K. Defect Assessment.

1.2 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittal procedures.

B. Section 01 42 16 - Definitions.

C. Section 01 45 33 - Code-Required Special Inspections and Procedures.

D. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

1.3 REFERENCE STANDARDS

A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2023).

B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2026.

C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2023.

D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2023.

E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2025a.

F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2026.

G. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components; 2016.

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H. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2025.

1.4 DEFINITIONS

A. Contractor's Professional Design Services: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.

1. Design Services Types Required:

a. Construction-Related: Services Contractor needs to provide in order to carry out the Contractor’s sole responsibilities for construction means, methods, techniques, sequences, and procedures.

b. Design-Related (Delegated Design): Design services explicitly required to be performed by another design professional due to highly-technical and/or specialized nature of a portion of the project. Services primarily involve engineering analysis, calculations, and design, and are not intended to alter the aesthetic aspects of the design.

B. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

C. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of five (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.

D. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

E. 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, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

F. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.

1. Mockups are used for one or more of the following:

a. Verify selections made under Sample submittals.

b. Demonstrate aesthetic effects.

c. Demonstrate the qualities of products and workmanship.

d. Demonstrate successful installation of interfaces between components and systems.

e. Perform preconstruction testing to determine system performance.

2. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.

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a. Testing and inspection services are required to verify compliance with requirements specified or indicated.

3. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.

G. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.

H. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

I. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).

J. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" shall have the same meaning as the term "testing agency."

K. 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.

L. 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. Contractor's quality-control services do not include contract administration activities performed by Architect.

1.5 CONTRACTOR'S PROFESSIONAL DESIGN SERVICES

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

B. Construction-Related:

1. 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:

a. Temporary sheeting, shoring, or supports.

b. Temporary scaffolding.

c. Temporary bracing.

d. Temporary falsework for support of spanning or arched structures.

e. Temporary foundation underpinning.

f. Temporary stairs or steps required for construction access only.

g. Temporary hoist(s) and rigging.

h. Investigation of soil conditions to support construction equipment.

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C. Design-Related (Delegated-Design): Provide such engineering design services as indicated on drawings and in individual specification sections.

1. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, base design on performance and/or design criteria indicated in individual specification sections.

a. Submit a Request for Interpretation to Architect if the criteria indicated are not sufficient to perform required design services.

2. Delegated-Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

3. Scope of Contractor's Professional Design Services: Provide for the items of Work indicated on Drawings and in individual specification Sections.

1.6 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified is 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.

1.7 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Designer's Qualification Statement: Submit for Architect's knowledge as contract administrator, or for Owner's information.

1. Include information for each individual professional responsible for producing, or supervising production of, design-related professional services provided by Contractor.

a. Full name.

b. Professional licensure information.

c. Statement addressing extent and depth of experience specifically relevant to design of items assigned to Contractor.

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C. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.

1. Include calculations that have been used to demonstrate compliance to performance and regulatory criteria provided, and to determine design solutions.
2. Include required product data and shop drawings.
3. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.
4. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.

D. Test Reports: After each test/inspection, promptly submit copies of report to Architect and to Contractor.

1. Include:
    a. Date issued.
    b. Project title and number.
    c. Name of inspector.
    d. Date and time of sampling or inspection.
    e. Identification of product and specifications section.
    f. Location in the Project.
    g. Type of test/inspection.
    h. Date of test/inspection.
    i. Results of test/inspection.
    j. Compliance with Contract Documents.
    k. When requested by Architect, provide interpretation of results.
2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.

E. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.

1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

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F. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

G. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.

1. Submit report in duplicate within 30 days of observation to Architect for information.

2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

H. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.

1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications:

1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.

2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.

3. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.

B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in Ohio.

1.9 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with reference standard of date of issue current on date of Agreement, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

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E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.10 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner will employ and pay for services of an independent testing agency to perform Building Code required special inspections; refer to Section 01 45 33.

B. Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.

C. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

D. Contractor Employed Agency:

1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM E699, ASTM C1021, ASTM C1077, ASTM C1093, and ASTM D3740.

2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.

3. Laboratory: Authorized to operate in Ohio.

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.

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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.

1. In-place mock-up requirements are specified in individual specification Sections.

B. Mockups are not Samples. Unless otherwise indicated, accepted mock-ups establish the standard of quality the Architect will use to judge the Work.

1. 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.
2. In-Place (In Situ) Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.
3. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
4. Laboratory Mockups: Full-size physical assemblies constructed and tested at testing facility to verify performance characteristics.

C. Notify Architect five (5) working days in advance of dates and times when mock-ups will be constructed.

D. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.

E. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

F. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

G. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.

1. Technical Review: Architect will issue written comments within three (3) working days of initial review and each subsequent follow up review of each mock-up's technical components.
2. Aesthetic Review: Architect will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up's aesthetic components.
3. Make corrections as necessary until Architect's approval is issued.

H. Architect will use accepted mock-ups as a comparison standard for the remaining Work.

I. 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.

J. Where possible salvage and recycle the demolished mock-up materials.

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3.3 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

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

3.4 TESTING AND INSPECTION

A. See drawings and individual specification sections for testing and inspection required.

B. Testing Agency Duties:

1. Test samples of mixes submitted by Contractor.
2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
3. Perform specified sampling and testing of products in accordance with specified standards.
4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
6. Perform additional tests and inspections required by Architect.
7. Attend preconstruction meetings and progress meetings.
8. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:

1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency may not approve or accept any portion of the Work.
3. Agency may not assume any duties of Contractor.
4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:

1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
2. Cooperate with laboratory personnel, and provide access to the Work.
3. Provide incidental labor and facilities:
    a. To provide access to Work to be tested/inspected.
    b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
    c. To facilitate tests/inspections.

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d. To provide storage and curing of test samples.

4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.

5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.5 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.6 DEFECT ASSESSMENT

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

B. If, in the opinion of Owner, it is not practical to remove and replace the work, Owner will direct an appropriate remedy or adjust payment.

END OF SECTION

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SECTION 01 42 16 - DEFINITIONS

PART 1 GENERAL

1.1 SUMMARY

A. This section supplements the definitions contained in the General Conditions.

B. Other definitions are included in individual specification sections.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Allowance: A quantity of work or dollar amount included in the Contract, established in lieu of additional requirements, used to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

C. 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 the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

D. Alteration Work: This term includes remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.

E. Approved: When used to convey Architect's action on Contractor's submittals, applications, and requests, approved is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

F. BIM: Building Information Modeling.

G. Consolidate: To strengthen loose or deteriorated materials in place.

H. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

I. Day: Business day or working day, typically Monday through Friday from 9 a.m. to 5 p.m.; any day except any Saturday, any Sunday, or any day which is a legal holiday or any day on which banking institutions are authorized or required by law or other governmental action to close.

J. Design Reference Sample: A sample that represents the Architect's prebid selection of work to be matched; it may be existing work or work specially produced for the Project.

K. Directed: A command or instruction by Architect. Other terms, including requested, authorized, selected, required, and permitted, have the same meaning as directed.

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L. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

M. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of five 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.

N. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

O. Furnish: To supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

P. Indicated: Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms, including shown, noted, scheduled, and specified, have the same meaning as indicated.

Q. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

R. Install: To unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, start up, make ready for use, and similar operations at Project site.

S. 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, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

T. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.

U. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.

1. Mockups are used for one or more of the following:

a. Verify selections made under Sample submittals.

b. Demonstrate aesthetic effects.

c. Demonstrate the qualities of products and workmanship.

d. Demonstrate successful installation of interfaces between components and systems.

e. Perform preconstruction testing to determine system performance.

2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.

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3. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.

V. Permanent Enclosure: As determined by Architect, the condition at which roofing is insulated and weathertight; exterior walls are insulated and weathertight; and openings are closed with permanent construction or substantial temporary closures equivalent in weather protection to permanent construction.

W. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.

X. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.

Y. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

Z. Project Manual: The book-sized volume that includes the procurement requirements (if any), the contracting requirements, and the specifications.

AA. Project Site: Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built

BB. Provide: To furnish and install, complete and ready for the intended use.

CC. RFI: Request for Information. Request from Owner, Construction Manager, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

DD. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.

EE. Regulations: Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

FF. Reinstall: To protect removed or dismantled item, repair and clean it as indicated for reuse, and reinstall it in original position, or where indicated.

GG. Remove: To take down or detach a nonhistoric item located within a historic space, area, or room, using methods and equipment to prevent damage to historic items and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

HH. Repair: To correct damage and defects, retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.

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II. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.

JJ. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.

KK. Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.

LL. Restore: To consolidate, replicate, reproduce, repair, and refinish as required to achieve the indicated results.

MM. Retain: To keep an element or detail secure and intact.

NN. Reversible: New construction work, treatments, or processes that can be removed or undone in the future without damaging historic materials unless otherwise indicated.

OO. Salvage: To protect removed or dismantled items and deliver them to Owner ready for reuse.

PP. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

QQ. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).

RR. Stabilize: To provide structural reinforcement of unsafe or deteriorated items while maintaining the essential form as it exists at present; also, to reestablish a weather-resistant enclosure.

SS. Strip: To remove existing finish down to base material unless otherwise indicated.

TT. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

UU. Supply: Same as Furnish.

VV. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."

WW. 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.

XX. 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. Contractor's quality-control services do not include contract administration activities performed by Architect.

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YY. Unit Price: 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.

ZZ. Wet Location: Typically "wet" spaces including kitchens, janitor's closets, toilet rooms, locker rooms with showers, exterior-accessed storage rooms.

AAA. Work Package: A group of specifications, drawings, and schedules prepared by the design team to describe a portion of the Project Work for pricing, permitting, and construction.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 45 33 - CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submittals.

1.2 DEFINITIONS

A. Code or Building Code: OBC, Ohio Building Code, most recent edition adopted by authority having jurisdiction, including all applicable amendments and supplements without limitation, and specifically Chapter 17 - Special Inspections and Tests.

B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.

C. NIST: National Institute of Standards and Technology.

D. Special Inspections and Tests: Inspections and testing of materials, installation, fabrication, erection, or placement of components and connections mandated by Building Code to safeguard public welfare.

1. Special inspections and tests are separate from and independent of tests and inspections conducted by Owner or Contractor for purposes of quality assurance and contract administration.

1.3 REFERENCE STANDARDS

A. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2025a.

B. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2025.

C. IAS AC291 - Accreditation Criteria for Special Inspection Agencies AC291; 2025, with Editorial Revision.

D. ISO/IEC 17020 - Conformity Assessment — Requirements for the Operation of Various Types of Bodies Performing Inspection; 2012.

E. ISO/IEC 17025 - General Requirements for the Competence of Testing and Calibration Laboratories; 2017.

F. OBC - Ohio Building Code; most recent edition.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Special Inspection Agency Qualifications: Prior to start of work, Special Inspection Agency is required to:

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1. Submit agency name, address, and telephone number, names of full time special inspector and responsible officer.
2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
3. Submit certification that Special Inspection Agency is acceptable to AHJ.
4. Submit documentation that Special Inspection Agency is accredited by IAS according to IAS AC291 or ISO/IEC 17020.

C. Testing Laboratory Qualifications: Prior to start of work, Testing Laboratory is required to:
1. Submit laboratory name, address, and telephone number, and names of full time specialist and responsible officer.
2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
3. Submit certification that Testing Agency is acceptable to AHJ.
4. Submit documentation that Testing Agency is accredited by IAS according to IAS AC89 or ISO/IEC 17025.

D. Fabricator's Qualification Statement: When required by AHJ, submit documentation of fabrication facilities and methods and quality control procedures. Include documentation of AHJ approval.

E. Special Inspection Reports: After each special inspection, Special Inspector is required to submit at least two copies of report; one to Architect and one to AHJ.
1. Include:
a. Date issued.
b. Project title and number.
c. Name of Special Inspector.
d. Date and time of special inspection.
e. Identification of product and specifications section.
f. Location in the Project.
g. Type of special inspection.
h. Date of special inspection.
i. Results of special inspection.
j. Compliance with contract documents.
2. Final Special Inspection Report: Document special inspections and correction of discrepancies prior to the start of the work.

F. Test Reports: After each test or inspection, Testing Agency is required to submit report to Architect and to AHJ.

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1. Include:
    a. Date issued.
    b. Project title and number.
    c. Name of inspector.
    d. Date and time of sampling or inspection.
    e. Identification of product and specifications section.
    f. Location in the Project.
    g. Type of test or inspection.
    h. Date of test or inspection.
    i. Results of test or inspection.
    j. Compliance with contract documents.

G. Certificates: When required by AHJ, Special Inspector will submit certification by fabricator to Architect and AHJ.
    1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

1.5 SPECIAL INSPECTION AND TESTING AGENCY

A. Owner or Architect to employ services of Special Inspection Agency to perform inspections and associated testing and sampling in accordance with ASTM E329 and required by building code.

B. Special Inspection Agency may delegate to independent testing agency to perform testing and sampling associated with special inspections and required by building code.

C. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of contract documents.

1.6 QUALITY ASSURANCE

A. Special Inspection Agency Qualifications:
    1. Independent firm specializing in performing testing and inspections of the type specified in this section.
    2. Accredited by IAS according to IAS AC291 or ISO/IEC 17020.

B. Testing Laboratory Qualifications:
    1. Independent firm specializing in performing testing and inspections of the type specified in this section.
    2. Accredited by IAS according to IAS AC89 or ISO/IEC 17025.

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PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 SPECIAL INSPECTIONS AND TESTING

A. The Code requires special inspections and testing of certain materials, components, assemblies, and connections used in constructing the project. Special inspections and testing will be performed in accordance with the Code.

B. Special inspections and testing will be performed in accordance with the Code for the following materials and project components:

1. Steel.
2. Concrete.
3. Masonry.
4. Soils.
5. Structural observations required by OBC section 1704.6.

3.2 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES

A. Special Inspection Agency shall:

1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
2. Perform specified sampling and testing of products in accordance with specified reference standards.
3. Ascertain compliance of materials and products with requirements of Contract Documents.
4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
5. Perform additional tests and inspections required by Architect.
6. Submit reports of all tests or inspections specified.

B. Limits on Special Inspection Agency Authority:

1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency may not approve or accept any portion of the work.
3. Agency may not assume any duties of Contractor.
4. Agency has no authority to stop the work.

C. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

D. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

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3.3 CONTRACTOR DUTIES AND RESPONSIBILITIES

A. Contractor Responsibilities, General:

1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.
2. Cooperate with agency and laboratory personnel; provide access to approved documents at project site, to the work, to manufacturers' facilities, and to fabricators' facilities.
3. Provide incidental labor and facilities:
    a. To provide access to work to be tested or inspected.
    b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
    c. To facilitate tests or inspections.
    d. To provide storage and curing of test samples.
4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.
5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

END OF SECTION

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SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Dewatering

B. Temporary utilities.

C. Temporary sanitary facilities.

D. Temporary Controls: Barriers, enclosures, and fencing.

E. Security requirements.

F. Waste removal facilities and services.

1.2 RELATED REQUIREMENTS

A. Section 01 57 13 - Temporary Erosion and Sediment Control.

B. Section 01 74 19 - Construction Waste Management and Disposal.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

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

1.4 USE CHARGES

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

1.5 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.

C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

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D. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.

1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.

2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

3. Indicate methods to be used to avoid trapping water in finished work.

1.6 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.

1.7 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.

1.8 DEWATERING

A. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Provide temporary means and methods for dewatering all temporary facilities and controls.

2. Maintain temporary facilities in operable condition.

B. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.

C. Remove snow and ice as required to minimize accumulations.

1.9 TEMPORARY UTILITIES

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. Owner will pay for the following:

1. Electrical power.

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2. Water and sewer.

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

1. Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

2. Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

3. Install water service and distribution piping in sizes and pressures adequate for construction.

4. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

5. Connect temporary drainage to sewer system indicated as directed by authorities having jurisdiction.

D. New permanent facilities may be used.

E. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.10 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures; include temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Provide at time of project mobilization.

1. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

B. New permanent facilities may not be used during construction operations.

C. Maintain daily in clean and sanitary condition.

1.11 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Provide protection for plants designated to remain. Replace damaged plants.

D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.12 FENCING

A. Construction: Contractor's option.

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B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.13 EXTERIOR ENCLOSURES

A. Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.14 INTERIOR ENCLOSURES

A. Provide temporary partitions as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and plywood sheet materials with closed joints and sealed edges at intersections with existing surfaces:

1.15 SECURITY

A. 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 workday.

B. Lighting: Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

1.16 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and Owner.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

F. Existing parking areas may not be used for construction parking.

1.17 WASTE REMOVAL

A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

C. Provide containers with lids. Remove trash from site daily.

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D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.18 FIELD OFFICES

A. Field Offices: Weathertight, prefabricated or mobile units with serviceable finishes, lighting, electrical outlets, heating, cooling and ventilating equipment, temperature controls, and foundations adequate for normal loading.

1. Equip with sturdy furniture, drawing rack, and drawing display table.

B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

C. Locate offices and sheds a minimum distance of 30 feet from existing and new structures.

1.19 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work.

2. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 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.

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B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.3 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.

1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

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: Refer to Section 01 57 13 - Temporary Erosion and Sediment Control.

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. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. Pest Control: If necessary, engage Owner's preferred vendor for pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals, so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.

G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.

H. 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 workday.

I. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

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. Comply with additional limits on smoking specified in other Sections.

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2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with 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.

3.4 MOISTURE AND MOLD CONTROL

A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.

B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard and replace stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.

D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

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a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.

b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.

c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

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. 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.

2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period.

3. Comply with final cleaning requirements specified in Section 01 70 00 - Execution and Closeout Requirements.

END OF SECTION

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SECTION 01 55 26 - TRAFFIC CONTROL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

B. Ohio Manual of Uniform Traffic Control Devices (OMUTCD).

C. Ohio Department of Transportation (ODOT) Construction and Material Specifications (CMS) and Standard Drawings.

1.2 SUMMARY

A. Section Includes:

1. Maintenance of vehicular and pedestrian traffic during and after construction.
2. Signs and pavement markings

1.3 SUBMITTALS

A. Informational:

1. Personnel Qualifications of individual responsible traffic control.
2. Sign and pavement marking material specifications.

PART 2 PRODUCTS

2.1 TRAFFIC CONTROL DEVICES, SIGNS AND PAVEMENT MARKINGS

A. Conform to governing jurisdictional requirements, the OMUTCD, ADA, and the ODOT Standard Specifications and Standard Drawings.

B. Reflectorize signs, barricades, and cones shall comply with the minimum requirements for the type of reflective sheeting as required by the OMUTCD.

C. Replace signs, barricades, cones, etc. on which the reflective sheeting falls below the original requirement.

PART 3 EXECUTION

A. Install construction traffic control devices that do not block or impede other existing traffic control devices, or sidewalks for pedestrians.

B. Continuously maintain construction zone traffic control devices in accordance with OMUTCD

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and ODOT Standard Specifications.

C. Remove device from the Project area when it is not in use for the period it is not needed or at a minimum remove device from the shoulder area for the period it is not needed.

END OF SECTION 01 55 26

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SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General product requirements.

B. Re-use of existing products.

C. Transportation, handling, storage and protection.

D. Product option requirements.

E. Substitution limitations.

F. Procedures for Owner-supplied products.

G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.2 DEFINITIONS

A. Basis of Design: A specification in which a single manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation. Published attributes and characteristics of basis of design product establish salient characteristics of products.

1. In addition to the basis of design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis of design product also establish salient characteristics of products for purposes of evaluating comparable products.

B. Basis of Design Submittal: An action submittal complying with requirements in Section 01 30 00 - Administrative Requirements.

C. Comparable Product Submittal: An action submittal complying with requirements in Section 01 25 00 - Substitution Procedures; requests consideration of products comparable to named basis of design product; includes the following information:

1. Identification of basis of design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.

2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.

D. OFCI: Owner-Furnished / Contractor-Installed.

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E. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.

2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.

3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

4. Or Equal Products: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in Comparable Product Request Submittals" paragraph to obtain approval for use of an unnamed product.

F. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

1.3 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Lists of products to be removed from existing building.

B. Section 01 25 00 - Substitution Procedures: Substitutions made during procurement and/or construction phases.

C. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.

1.4 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

1. Major Products:

a. Major components of MEP systems.

b. Products with long lead times.

c. Roofing.

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d. Products proposed in lieu of named Basis-of-Design products.

2. Submit within 15 days after date of Agreement.

3. For products specified only by reference standards, list applicable reference standards.

B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

E. Comparable Product Request Submittals: An action submittal requesting consideration of a comparable product, including the following information:

1. Identification of basis of design product to be replaced, including Specification Section number and title and Drawing numbers and titles.

2. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.

3. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.

4. Evidence that proposed product provides specified warranty.

5. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.

6. Samples, if indicated or requested.

F. Substitution Request: Refer to Section 01 25 00 - Substitution Procedures for definition and limitations on substitutions.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1. Resolution of Compatibility Disputes between Multiple Contractors:

a. Contractors are responsible for providing products and construction methods compatible with products and construction methods of other contractors.

b. If a dispute arises between the multiple contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

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B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.

2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:

a. Name of product and manufacturer.

b. Model and serial number.

c. Capacity.

d. Speed.

e. Ratings.

3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.6 COORDINATION

A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.

2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.

C. Storage:

1. Provide a secure location and enclosure at Project site for storage of materials and equipment.

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2. Store products to allow for inspection and measurement of quantity or counting of units.
3. Store materials in a manner that will not endanger Project structure.
4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.8 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents
   1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
   2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
   1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
   2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
   3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 78 00 - Closeout Submittals.

PART 2 PRODUCTS

2.1 PRODUCTS, GENERAL

A. Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

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1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

2.2 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.

B. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

C. Specific Products to be Reused: The reuse of certain materials and equipment already existing on the project site is required when explicitly indicated on drawings.

1. See drawings for list of items required to be salvaged for reuse and relocation.
2. If reuse of other existing materials or equipment is desired, submit substitution request.

2.3 NEW PRODUCTS

A. Provide new products that comply with requirements, are undamaged, and are new at time of installation, unless specifically required or permitted by Contract Documents.

B. Use of products having any of the following characteristics is not permitted:

1. Made of wood from newly cut old growth timber.
2. Containing lead, cadmium, or asbestos.

C. Where other criteria are met, Contractor shall give preference to products that:

1. If used on interior, have lower emissions.
2. If wet-applied, have lower VOC content.

D. Provide interchangeable components by the same manufacture for components being replaced.

2.4 PRODUCT OPTIONS

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

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B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

D. Basis of Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named.

1. Provide either the product identified as "Basis of Design" or an equivalent product by one of the other named manufacturers. For any product not identified as "Basis of Design" submit information as required in "Comparable Products" Article.

2. For approval of products by unnamed manufacturers, comply with requirements in Section 01 25 00 - Substitution Procedures for substitutions for convenience.

E. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 - Substitution Procedures for proposal of product.

F. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.5 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:

1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.

2. Detailed comparison of significant qualities of proposed product with those of the named basis of design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.

3. Evidence that proposed product provides specified warranty.

4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.

B. Samples, if requested.

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C. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 01 30 00 - Administrative Requirements.

1. Form of Approval of Submittal: As specified in Section 01 30 00 - Administrative Requirements.

2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

D. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

E. Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by the Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

2.6 MAINTENANCE MATERIALS (ATTIC STOCK)

A. See Section 01 78 00 - Closeout Submittals.

PART 3 EXECUTION

3.1 SUBSTITUTION LIMITATIONS

A. See Section 01 25 00 - Substitution Procedures.

3.2 OWNER-SUPPLIED PRODUCTS (OFCI)

A. Owner's Responsibilities:

1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.

2. Arrange and pay for product delivery to site.

3. On delivery, inspect products jointly with Contractor.

4. Submit claims for transportation damage and replace damaged, defective, or deficient items.

5. Arrange for manufacturers' warranties, inspections, and service.

6. Inform Contractor of earliest available delivery date for Owner-furnished products.

B. Contractor's Responsibilities:

1. Designate delivery dates of Owner-furnished products in Contractor's construction schedule, utilizing Owner-furnished earliest available delivery dates.

2. Review Owner reviewed shop drawings, product data, and samples.

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3. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
4. Handle, store, install and finish products.
5. Make building services connections for Owner-supplied products.
6. Protect Owner-supplied products from damage during storage, handling, and installation and prior to Substantial Completion.
7. Repair or replace items damaged after receipt.

3.3 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.

3.4 STORAGE AND PROTECTION

A. Provide protection of stored materials and products against theft, casualty, or deterioration.

B. 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.

C. Structural Loading Limitations: Handle and store products and materials so as not to exceed static and dynamic load-bearing capacities of project floor and roof areas.

D. Store and protect products in accordance with manufacturers' instructions.

E. Store with seals and labels intact and legible.

F. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.

G. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

H. For exterior storage of fabricated products, place on sloped supports above ground.

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I. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

J. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

K. Comply with manufacturer's warranty conditions, if any.

L. Do not store products directly on the ground.

M. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

N. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

O. Prevent contact with material that may cause corrosion, discoloration, or staining.

P. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

Q. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

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SECTION 01 70 00 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition.

C. Pre-installation meetings.

D. Cutting and patching.

E. Surveying for laying out the work.

F. Cleaning and protection.

G. Starting of systems and equipment.

H. Demonstration and instruction of Owner personnel.

I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

1.2 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Limitations on working in existing building.

B. Section 01 76 10 - Temporary Protective Coverings: Materials for protection of installed work.

C. Section 01 78 00 - Closeout Submittals: Project record documents, operation and maintenance data, maintenance materials, warranties.

D. Section 01 79 00 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

E. Individual Product Specification Sections:

1. Advance notification to other sections of openings required in work of those sections.

2. Limitations on cutting structural members.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

C. Punch List: Contractor-prepared list of items to be completed or corrected before the Contract Work shall be considered Finally Complete.

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D. Substantial Completion: That point in time, as determined by the Owner and Design Team, that the Contract Work, or an agreed upon portion of the Contract Work, is found to be completed enough that the Owner may legally occupy the space of the Contract Work and use that space for the purpose for which it was intended. There must be only minor items left to be repaired or installed.

E. Final Completion: That point in time, as determined by the Owner and Design Team, when all Punch List items have been resolved to the Owner's satisfaction and the Contract Work is found to be complete and all Contract requirements satisfied.

1.4 REFERENCE STANDARDS

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

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.

1. On request, submit documentation verifying accuracy of survey work.
2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
3. Submit surveys and survey logs for the project record.

C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:

1. Structural integrity of any element of Project.
2. Integrity of weather exposed or moisture resistant element.
3. Efficiency, maintenance, or safety of any operational element.
4. Visual qualities of sight exposed elements.
5. Work of Owner or separate Contractor.
6. Include in request:
    a. Identification of Project.
    b. Location and description of affected work.
    c. Necessity for cutting or alteration.
    d. Description of proposed work and products to be used.
    e. Alternatives to cutting and patching.
    f. Effect on work of Owner or separate Contractor.
    g. Written permission of affected separate Contractor.
    h. Date and time work will be executed.

D. Project Record Documents: Accurately record actual locations of capped and active utilities.

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1.6 QUALIFICATIONS

A. For demolition work, employ a firm specializing in the type of work required.

B. For surveying work, employ a land surveyor registered in Ohio and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

C. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in Ohio. Employ only individual(s) trained and experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or complexity.

D. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in Ohio.

1.7 PROJECT CONDITIONS

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

C. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.

D. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

1. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.

E. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

F. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.8 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

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D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.1 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.2 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

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B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.3 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect four days in advance of meeting date.

D. Prepare agenda and preside at meeting:

1. Review conditions of examination, preparation and installation procedures.
2. Review coordination with related work.

E. Record minutes and distribute electronically within three (3) days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.4 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

F. Utilize recognized engineering survey practices.

G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:

1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
2. Grid or axis for structures.
3. Building foundation, column locations, ground floor elevations.
4. Controlling lines and levels required for mechanical and electrical trades.

H. Periodically verify layouts by same means.

I. Maintain a complete and accurate log of control and survey work as it progresses.

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3.5 GENERAL INSTALLATION REQUIREMENTS

A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.

B. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

C. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

D. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

E. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

F. Make neat transitions between different surfaces, maintaining texture and appearance.

3.6 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.

1. Verify that construction and utility arrangements are as indicated.
2. Report discrepancies to Architect before disturbing existing installation.
3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.

1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

C. Remove existing work as indicated and as required to accomplish new work.

1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
2. Remove items indicated on drawings.
3. Relocate items indicated on drawings.
4. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
5. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.

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1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
3. Verify that abandoned services serve only abandoned facilities.
4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

E. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.

F. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
3. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.

G. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

H. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

I. Clean existing systems and equipment.

J. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

K. Do not begin new construction in alterations areas before demolition is complete.

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

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3.7 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching of in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Provide temporary support of Work to be cut.
2. Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
3. Where existing utility services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

B. Whenever possible, execute the work by methods that avoid cutting or patching.

C. See Alterations article above for additional requirements.

D. Perform whatever cutting and patching is necessary to:

1. Complete the work.
2. Fit products together to integrate with other work.
3. Provide openings for penetration of mechanical, electrical, and other services.
4. Match work that has been cut to adjacent work.
5. Repair areas adjacent to cuts to required condition.
6. Repair new work damaged by subsequent work.
7. Remove samples of installed work for testing when requested.
8. Remove and replace defective and non-complying work.

E. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to specified condition.

F. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

G. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval. Use methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

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4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

H. Restore work with new products in accordance with requirements of Contract Documents.

I. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

J. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Exposed Finishes: Finish patched surfaces to match finish that existed prior to patching and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.
2. Match color, texture, and appearance.
3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.
4. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
5. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.
6. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
7. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
8. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

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3.8 PROGRESS CLEANING

A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
    a. Use containers intended for holding waste materials of type to be stored.
4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

1. Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.
2. Remove liquid spills promptly.

C. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

D. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

1. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

E. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

F. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

G. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

H. Collect and remove waste materials, debris, and trash/rubbish from site daily and dispose off-site; do not burn or bury. Do not wash waste materials down sewers or into waterways.

I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

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K. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 PROTECTION OF INSTALLED WORK

A. See Section 01 76 10 for temporary protective covering materials.

B. Protect installed work from damage by construction operations.

C. Provide special protection where specified in individual specification sections.

D. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

E. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

F. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

G. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.

H. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

I. Prohibit traffic from landscaped areas.

J. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Architect and Owner seven days prior to start-up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify that wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

1. Remove malfunctioning units, replace with new units, and retest.

2. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

3. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

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G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

A. See Section 01 79 00 - Demonstration and Training.

3.12 ADJUSTING

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

B. Testing, adjusting, and balancing HVAC systems: See Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.

3.13 FINAL CLEANING

A. Preform first final cleaning immediately before punchlist, immediately prior to anticipated date of Substantial Completion.

B. Execute final cleaning after Substantial Completion but before making final application for payment.

1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.

C. Use cleaning materials that are nonhazardous.

D. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

E. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

F. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

G. Clean filters of operating equipment.

H. Clean debris from roofs, gutters, downspouts, overflow drains, area drains, and drainage systems.

I. Clean site; sweep paved areas, rake clean landscaped surfaces.

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

3.14 PROTECTION OF INSTALLED CONSTRUCTION

A. See Section 01 76 10 - Temporary Protective Coverings.

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3.15 CORRECTION OF THE WORK

A. Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.

C. Restore permanent facilities used during construction to their specified condition.

D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

F. Remove and replace chipped, scratched, and broken glass or reflective surfaces

3.16 SUBSTANTIAL COMPLETION PROCEDURES

A. Submittals Due: Prior to requesting a Punch List Inspection, Contractor shall prepare/obtain and submit the following items to the Owner, via the Architect.

1. Contractor's List of Incomplete Items: Contractor shall prepare a list of all remaining items to be completed and corrected, indicating the value of each item on the list and reasons why the Work is incomplete.

2. Certificates of Release: Contractor shall obtain and submit all releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Such releases shall include but are not limited to:

a. Occupancy Permits.

b. Operating Certificates.

3. Closeout Submittals: Contractor shall obtain and submit all closeout submittals indicated throughout the Contract Documents. Such submittals shall include but are not limited to:

a. Project (Contractor, Subcontractors and Suppliers) Directory.

b. Project Record Documents.

c. Operation and Maintenance Data.

d. Damage or Settlement Surveys.

e. Property Surveys.

f. Warranties.

g. Workmanship Bonds.

h. Maintenance Service Agreements

i. Maintenance material specified in individual Sections, including but not limited to:

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1) Tools.
2) Spare Parts.
3) Extra materials.

4. Tests/Adjust/Balance Records: Contractor shall obtain and submit all test/adjust/balance records.
5. Sustainable Design Submittals: Contractor shall obtain and submit all sustainable design submittals required in Division 01 Sections as well as individual Sections throughout the Specification.
6. Changeover Information: Contractor shall obtain and submit all changeover information related to Owner's occupancy, use, operation, and maintenance.

B. Procedures Due: Prior to, or concurrent with, requesting a Punch List Inspection, Contractor shall complete the following procedures and submit written evidence to the Owner, via the Architect, verifying that each procedure has been completed or satisfied.

1. Submit calendar schedule for anticipated of punch list date(s) by Trade, or by Room.
2. Advise Owner of pending insurance changeover requirements.
3. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
4. Complete startup and testing of systems and equipment.
5. Perform preventive maintenance on equipment used prior to Substantial Completion.
6. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
7. Advise Owner of changeover in heat and other utilities.
8. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
9. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
10. Complete final cleaning requirements, including touchup painting.
11. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

C. Request for Punch List Inspection: After the above items and procedures have been completed, submitted, and accepted by the Owner, Contractor shall submit a written request to the Architect for a Punch List Inspection to determine if the Contract Work is Substantially Complete.

1. Upon receipt of this written request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements that, in their opinion, indicate that the Punch List Inspection would be premature.

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2. If the Architect proceeds with the inspection, they will prepare a Punch List of minor items that are unacceptable, incomplete or missing. They will also prepare a Certificate of Substantial Completion indicating that they found the Contract Work to be Substantially Complete with the exception of the minor items contained in the Punch List.

3.17 FINAL COMPLETION PROCEDURES

A. Warranties: Contractor shall obtain and submit all warranty submittals indicated throughout the Contract Documents.

B. Correction of Punch List items: Contractor shall correct or complete all Punch List items, to the satisfaction of the Owner, within ninety (90) days of the date of Substantial Completion, unless otherwise agreed to in writing by the Owner.

C. Re-inspection: When the Contractor has corrected or completed all the Punch List items, they shall submit a written request to the Architect for a re-inspection of the Punch List items to verify that the Contract Work is Finally Complete.

1. Upon receipt of this written request, Architect will either proceed with re-inspection or notify Contractor of unfulfilled requirements that, in their opinion, indicate that the re-inspection would be premature.

2. If the Architect verifies that all Punch List items have been corrected or completed, they shall notify the Owner and Contractor in writing of their finding and declare the Contract Work Finally Complete.

D. Final Application for Payment: If the Architect’s re-inspection indicates that the Contract Work has been found to be Finally Complete, then the Contractor may submit their Final Application for Payment.

3.18 CLOSEOUT PROCEDURES

A. Refer to Section 01 78 00 for additional requirements.

B. Make submittals that are required by governing or other authorities.

C. Conduct preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.

D. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

E. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

F. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

G. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

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H. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

I. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

END OF SECTION

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SECTION 01 78 00 - CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Project record documents.

B. Operation and maintenance data.

C. Warranties and bonds.

D. Maintenance materials (attic stock).

1.2 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Section 01 70 00 - Execution and Closeout Requirements: Contract closeout procedures.

C. Individual Product Sections:

1. Specific requirements for operation and maintenance data.

2. Warranties required for specific products or Work.

3. Specific requirements for maintenance materials.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 SUBMITTALS

A. Project Record Documents: Submit documents to Architect.

B. Operation and Maintenance Manuals:

1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.

2. Submit electronic copy of completed documents 15 days prior to final inspection. This electronic copy will be reviewed and returned after final inspection, with Architect comments. Revise content as required prior to final submission.

3. Submit revised final documents in final form within 10 days after final inspection; include:

a. One (1) digital format, searchable PDF.

b. Three (3) hard copies.

C. Plumbing Schematics: Provide four (4) half-size sets of laminated piping schematics.

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D. Warranties and Bonds:

1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

E. Maintenance Materials (Attic Stock):

1. Submit schedule of maintenance material items; include name and quantity of each item and name and number of related Specification Section.
2. Submit one copy of schedule 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of schedule as required prior to final submission.
3. Submit revised schedule with delivery of maintenance material items within 10 days after Date of Substantial Completion, prior to final Application for Payment.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:

1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:

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1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
3. Field changes of dimension and detail.
4. Details not on original Contract drawings.

3.2 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.3 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:

1. Product data, with catalog number, size, composition, and color and texture designations.
2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification sections.

E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.4 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:

1. Description of unit or system, and component parts.
2. Identify function, normal operating characteristics, and limiting conditions.
3. Include performance curves, with engineering data and tests.

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4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

D. Include color coded wiring diagrams as installed.

E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

1. Include HVAC outdoor and exhaust air damper calibration strategy.

a. Include provisions which ensure that full closure of dampers can be achieved.

G. Provide servicing and lubrication schedule, and list of lubricants required.

H. Include manufacturer's printed operation and maintenance instructions.

I. Include sequence of operation by controls manufacturer.

J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

K. Provide control diagrams by controls manufacturer as installed.

L. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

M. Plumbing Schematics: Provide as installed piping schematics.

N. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

O. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

P. Include test and balancing reports.

Q. Additional Requirements: As specified in individual product specification sections.

3.5 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

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D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

J. Arrangement of Contents: Organize each volume in parts as follows:

1. Project Directory.
2. Table of Contents, of all volumes, and of this volume.
3. Operation and Maintenance Data: Arranged by system, then by product category.
    a. Source data.
    b. Product data, shop drawings, and other submittals.
    c. Operation and maintenance data.
    d. Field quality control data.
    e. Photocopies of warranties and bonds.

3.6 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.

F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

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G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

3.7 MAINTENANCE MATERIALS (ATTIC STOCK)

A. Furnish extra materials, spare parts, tools, software and similar items of types and in quantities specified in individual specification sections.

1. Label maintenance materials with manufacturers' names and items' model numbers.

B. Deliver to Project site, location designated by Owner; obtain receipt prior to final payment.

END OF SECTION

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SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.1 SUMMARY

A. Demonstration of products and systems where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:

1. All software-operated systems.
2. HVAC systems and equipment.
3. Plumbing equipment.
4. Electrical systems and equipment.
5. Items specified in individual product Sections.

C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:

1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
2. Finishes, including flooring, wall finishes, ceiling finishes.
3. Fixtures and fittings.
4. Items specified in individual product Sections.

1.2 RELATED REQUIREMENTS

A. Section 01 78 00 - Closeout Submittals: Operation and maintenance manuals.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
2. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
3. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

B. Pre-Instruction Meeting: Review methods and procedures related to demonstration and training.

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.

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4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.

1. Submit to Architect for transmittal to Owner.
2. Submit not less than two weeks prior to start of training.
3. Revise and resubmit until acceptable.
4. Provide an overall schedule showing all training sessions.
5. Include at least the following for each training session:
    a. Identification, date, time, and duration.
    b. Description of products and/or systems to be covered.
    c. Name of firm and person conducting training; include qualifications.
    d. Intended audience, such as job description.
    e. Objectives of training and suggested methods of ensuring adequate training.
    f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
    g. Media to be used, such a slides, hand-outs, etc.
    h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.

1. Include applicable portion of O&M manuals.
2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
3. Provide one extra copy of each training manual to be included with operation and maintenance data.

D. Training Reports:

1. Identification of each training session, date, time, and duration.
2. Sign-in sheet showing names and job titles of attendees.
3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.

E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.

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1. Format: DVD Disc.
2. Label each disc and container with session identification and date.

1.5 QUALITY ASSURANCE

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstration may be combined with Owner personnel training if applicable.

C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.2 TRAINING - GENERAL

A. Conduct training on-site unless otherwise indicated.

B. Owner will provide classroom and seating at no cost to Contractor.

C. Provide training in minimum two hour segments.

D. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

E. Review of Facility Policy on Operation and Maintenance Data: During training discuss:

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1. The location of the O&M manuals and procedures for use and preservation; backup copies.
2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
3. Typical uses of the O&M manuals.

F. Product- and System-Specific Training:

1. Review the applicable O&M manuals.
2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
4. Provide hands-on training on all operational modes possible and preventive maintenance.
5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
6. Discuss common troubleshooting problems and solutions.
7. Discuss any peculiarities of equipment installation or operation.
8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
9. Review recommended tools and spare parts inventory suggestions of manufacturers.
10. Review spare parts and tools required to be furnished by Contractor.
11. Review spare parts suppliers and sources and procurement procedures.

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

END OF SECTION

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SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Selective demolition of building elements for alteration purposes.

B. Abandonment and removal of existing utilities and utility structures.

1.2 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.

B. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

C. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

1.3 DEFINITIONS

A. Demolish: Dismantle, raze, destroy, or wreck any building or structure or any part thereof.

B. Demo: Same as dismantle.

C. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

D. Remove: Detach or dismantle items from existing construction and dispose of them off site, unless items are indicated to be salvaged or reinstalled.

E. Remove and Salvage: Detach or dismantle items from existing construction in a manner to prevent damage. Clean, package, label and deliver salvaged items to Owner in ready-for-reuse condition.

F. Remove and Reinstall: Detach or dismantle items from existing construction in a manner to prevent damage. Clean and prepare for reuse and reinstall where indicated.

G. Existing to Remain: Designation for existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.4 REFERENCE STANDARDS

A. ANSI/ASSP A10.6 - Safety and Health Program Requirements for Demolition Operations; current edition.

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

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1.5 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.6 ADMINISTRATIVE REQUIREMENTS

A. Predemolition Conference:

1. Inspect and discuss condition of construction to be selectively demolished.

2. Review structural load limitations of existing structure.

3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.

4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.

5. Review areas where existing construction is to remain and requires protection.

1.7 FIELD CONDITIONS

A. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

B. Storage or sale of removed items or materials on-site is not permitted.

C. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.1 PREPARATION

A. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

B. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.

2. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.

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3. Cover and protect furniture, furnishings, and equipment that have not been removed.
4. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 50 00.

C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.2 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with requirements in Section 01 70 00.

B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.

1. Obtain required permits.
2. Comply with applicable requirements of ANSI/ASSP A10.6 and NFPA 241.
3. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
4. Provide, erect, and maintain temporary barriers and security devices.
5. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
6. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
7. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.
8. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.

C. Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work.

1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.

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4. Maintain fire watch during and for at least 30 minutes after flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.

D. Do not begin removal until receipt of notification to proceed from Owner.

E. Do not begin removal until built elements to be salvaged or relocated have been removed.

F. Do not begin removal until vegetation to be relocated has been removed and vegetation to remain has been protected from damage.

G. Protect existing structures and other elements to remain in place and not removed.
1. Provide bracing and shoring.
2. Prevent movement or settlement of adjacent structures.
3. Stop work immediately if adjacent structures appear to be in danger.

H. Minimize production of dust due to demolition operations. Do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

I. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
1. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCBs, and mercury.

J. Perform selective demolition of exterior construction in a manner that maximizes salvage of existing face brick.

K. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

3.3 EXISTING UTILITIES

A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

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F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.4 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.

1. Verify construction and utility arrangements are as indicated.
2. Report discrepancies to Architect before disturbing existing installation.
3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Maintain weatherproof exterior building enclosure, except for interruptions required for replacement or modifications; prevent water and humidity damage.

C. Remove existing work as indicated and required to accomplish new work.

1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction indicated.
2. Remove items indicated on drawings.

D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment to the extent indicated.

1. Maintain existing active systems to remain in operation, and maintain access to equipment and operational components.
2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
3. See Section 01 10 00 - Summary for limitations on outages and required notifications.
4. Verify that abandoned services serve only abandoned facilities before removal.
5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings. Remove back to source of supply where possible, otherwise cap stub and tag with identification.

E. Protect existing work to remain.

1. Prevent movement of structure. Provide shoring and bracing as required.
2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.
4. Patch to match new work.

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3.5 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Remove materials not to be reused on site; do not burn or bury.

C. Do not allow demolished materials to accumulate on-site.

D. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

E. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

3.6 CLEANING

A. Leave site in clean condition, ready for subsequent work.

B. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

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SECTION 03 05 16 - UNDERSLAB VAPOR RETARDERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Sheet vapor retarder assembly under concrete slabs on grade.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Preparation of subgrade, granular fill, placement of concrete.

1.3 DEFINITIONS

A. Vapor-Retarder Material: A primary element that provides a continuous retarder to the movement of water vapor.

B. Vapor-Retarder Accessory: A transitional component of the vapor retarder that provides continuity.

C. Vapor-Retarder Assembly: The collection of vapor-retarder materials and accessories installed beneath a cast-in-place concrete slab, including joints and junctions to abutting construction, to prevent water vapor movement into the slab-on-grade.

1.4 REFERENCE STANDARDS

A. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting; 2018.

B. ASTM D1709 - Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method; 2024.

C. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover; 2008a (Reapproved 2025).

D. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2024.

E. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017 (Reapproved 2023).

F. ASTM F1249 - Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor; 2025.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting prior to the start of the work of this Section. Require attendance by all affected installers and manufacturer's field service representative.

1. Review vapor-retarder installation requirements, special details, mockups, manufacturer's field service inspections and testing, vapor-retarder assembly protection, and work scheduling that covers vapor retarders

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1.6 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions, procedures, and interface required with adjacent construction.

C. Samples: Submit samples of underslab vapor retarder to be used.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

PART 2 PRODUCTS

2.1 MATERIALS

A. Underslab Vapor Retarder:

1. Sheet Material: ASTM E1745, Class A, except with maximum water-vapor permeance specified; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs.

a. Water Vapor Permeance: Not more than 0.010 perms, maximum when tested in accordance with ASTM F1249 or ASTM E154/E154M, before and after conditioning.

b. Tensile Strength: 70 lbf/in minimum; ASTM D882.

c. Puncture Resistance: 2,200 grams minimum; ASTM D1709.

d. Thickness: 15 mils, minimum.

2. Available Products:

a. Henry Company; Moistop Ultra 15: www.henry.com.

b. Inteplast Group; Barrier-Bac VB-350: www.barrierbac.com.

c. Reef Industries, Inc; Griffolyn 15-mil Green: www.reefindustries.com.

d. (Basis of Design) Stego Industries, LLC; Stego Wrap Vapor Barrier (15-mil): www.stegoindustries.com.

e. Tex-Trude, LP; Xtreme Vapor Barrier (15-mil): www.tex-trude.com.

f. W. R. Meadows, Inc; PERMINATOR Class A - 15 mils (0.38 mm): www.wrmeadows.com.

B. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations in vapor retarder as required for a complete assembly.

1. Joint Tape: Pressure-sensitive self-adhering type, and of perm rating not less than vapor retarder sheet.

2. Adhesive: Non-sagging grade, compatible with sheet and substrate.

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3. Seam Tape: High density polyethylene (HDPE) tape with pressure-sensitive adhesive; minimum 4 inches wide.
4. Termination Mastic: Single component, trowel grade, polymer-modified, water-based emulsion.
5. Pipe Boots: Pre-fabricated, polyethylene sheet vapor retarder pipe boot/patch specifically designed for pipe penetrations.

C. Source Limitations: Obtain sheet vapor retarder and accessories from single source from single manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surface over which vapor retarder is to be installed is complete and ready before proceeding with installation of vapor retarder.

3.2 PREPARATION

A. Vapor Retarder Over Granular Fill: Install compactible granular fill before placing vapor retarder as indicated on drawings.

3.3 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
1. Install vapor retarder under interior slabs on grade; turn up at slab edge, and seal perimeter to slab.
2. Install vapor retarder with longest dimension parallel with direction of concrete pour.
3. Face laps away from exposed direction of concrete pour.
4. Lap vapor retarder over footings and grade beams not less than 6 inches sealing vapor retarder to concrete.
5. Lap joints 6 inches, minimum, and seal with manufacturer's recommended tape.
6. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
7. Seal joints, seams and penetrations in accordance with vapor retarder manufacturer's instructions. Provide manufacturer's recommended accessories for each application indicated.
    a. No penetration of vapor retarder is allowed except for reinforcing steel and permanent utilities.
8. Protect vapor retarder during placement of reinforcement and concrete.
    a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

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b. Repair damaged vapor retarder before covering with other materials.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide vapor retarder manufacturer's field services consisting of product recommendations and site visits for inspection of product installation.

1. Daily site attendance is required during installation of the Work.
2. Furnish daily reports to Architect.

B. Before placing concrete, verify that vapor retarder is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

C. If tests or inspections show that installation of vapor retarder does not comply with requirements, remove and replace or repair the vapor retarder as recommended in writing by manufacturer, and make further repairs after retesting and inspecting until the vapor retarder installation passes.

END OF SECTION

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SECTION 03 15 16 - CONCRETE CONSTRUCTION JOINT FILLERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Joint devices with removable top section for isolation joints in horizontal concrete work.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 07 92 00 - Joint Sealants: Elastomeric sealants and joint fillers for saw cut joints and isolation joints in slabs.

1.3 REFERENCE STANDARDS

A. ASTM D5249 - Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints 2016.

B. ASTM D4819 - Standard Specification for Flexible Cellular Materials Made From Polyolefin Plastics; 2013 R21(E1).

C. ASTM D8139 - Standard Specification for Semi-Rigid, Closed-Cell Polypropylene Foam, Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction; 2023.

D. ASTM D7174 - Standard Specification for Preformed Closed-Cell Polyolefin Expansion Joint Fillers for Concrete Paving and Structural Construction 2016.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

PART 2 PRODUCTS

2.1 JOINTING PRODUCTS

A. Slab Isolation Joint Filler: ASTM D8139 and ASTM D4819 Type II. Foam joint filler and bond-breaker backing for elastomeric joint sealants; removable top strip that forms a sealant pocket after removal.

1. Material: ASTM D7174 and ASTM D5249, closed-cell, non-staining, foam.

2. Configuration: Total height equal to thickness of slab; nominal 1/2 inch thickness, unless indicated otherwise.

3. Products:

a. NMW, Inc; Foamtech Concrete Expansion Joint Filler: www.nmwinc.com.

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b. Nomaco, Inc; Fastflex Slab Isolation Joint Filler with Tear-Off Strip: www.nomaco.com.

c. W. R. Meadows, Inc; Deck-O-Foam Joint Filler with pre-scored top strip: www.wrmeadows.com.

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

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

A. Coordinate installation of joint fillers with work of Section 03 30 00 - Cast-in-Place Concrete.

3.2 EXAMINATION

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

3.3 SLAB JOINTING

A. Locate where concrete slab isolation joints are indicated on drawings.

B. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.

C. Anchor joint fillers and devices to prevent movement during concrete placement; set removable top strip flush with top of slab.

END OF SECTION

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SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

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 cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1. Footings.
2. Grade beams
3. Slabs-on-grade (ground).

B. Related Requirements:

1. Section 312200 "Earth Moving" for drainage fill under slabs-on-grade.
2. Section 321313 "Concrete Paving" for concrete pavement and walks.
3. Section 321313 "Concrete Paving" for concrete pavement and walks.

C. Coordination: Unless other satisfactory agreements are specifically entered into by contractors concerned, all miscellaneous iron and steel, sleeves, anchors, etc., required by work of other contractors will be furnished and installed by such other contractors with the cooperation of this contractor.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

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1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

    a. Contractor's superintendent.
    b. Independent testing agency responsible for concrete design mixtures.
    c. Ready-mix concrete manufacturer.
    d. Concrete Subcontractor.
    e. Agency responsible for field quality control and special inspections.
    f. Primary admixture manufacturers.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness concrete repair procedures, and concrete protection.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.
2. Laboratory test reports for concrete mix design with the following data:

    a. Method used to determine the proposed mix design per ACI 301, Article 4.2.3.
    b. Gradation and quantity of fine and coarse aggregates.
    c. Proportions of all ingredients including all admixtures added either at the time of batching or at the job site.
    d. Water/cement ratio and water/cementitious ratio.
    e. Slump - ASTM C143.
    f. Certification and test results of the total water-soluble chloride ion content of the design mix - FHWA RD-77 or AASHTO T 260-84.
    g. Air content of freshly mixed concrete by the pressure method, ASTM C231, or the volumetric method, ASTM C173.
    h. Unit weight of concrete - ASTM C138.
    i. Equilibrium Unit Weight (for radiation shielding concrete) – ASTM C567 Calculated method based on Equation 9-5 and Equation 9-6.
    j. Strength at 7 and 28 days - ASTM C39, Document strength on basis of previous field experience or trial mixtures per ACI 301 Article 4.2.3. Submit strength test records, mix design materials, conditions, and proportions for concrete used for record of tests, standard calculation, and determination of required average compressive strength.

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C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Architect.

E. Samples: For vapor retarder

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer, testing agency.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Curing compounds.
6. Floor and slab treatments.
7. Bonding agents.
8. Adhesives.
9. Vapor retarders.
10. Semi-rigid joint filler.
11. Joint-filler strips.
12. Repair materials.

D. Material Test Reports: For the following, from a qualified testing agency:

1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

E. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing fabrication, assembly, and support of formwork.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

F. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

G. Field quality-control reports.

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H. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. 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 formwork and shoring and reshoring installations that are similar to those indicated for this Project in material, design, and extent.

C. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

D. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field-Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

E. Special Inspector Qualifications: A qualified person employed or retained by an approved agency that has the recommended experience and certifications as summarized in Appendix C of the current International Code Council (ICC) Special Inspection Manual.

F. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

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1.10 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301.
2. ACI 117.
3. ACI 315, "Details and Detailing of Concrete Reinforcement”

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

a. High-density overlay, Class 1 or better.

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b. Medium-density overlay, Class 1 or better; mill-release agent-treated and edge sealed.
c. Structural 1, B-B or better; mill-oiled and edge sealed.
d. B-B (Concrete Form), Class 1 or better; mill-oiled and edge sealed.

3. Overlaid Finnish birch plywood.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

H. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

I. Form Ties: Factory-fabricated, removable, or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706, deformed.

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C. Galvanized Reinforcing Bars: ASTM A 615, Grade 60, deformed bars, ASTM A 767, Class I zinc coated after fabrication and bending.

D. Epoxy-Coated Reinforcing Bars: ASTM A 615, Grade 60, deformed bars,, epoxy coated, with less than 2 percent damaged coating in each 12-inch bar length.

E. Steel Bar Mats: ASTM A 184, fabricated from ASTM A 615, Grade 60, deformed bars, assembled with clips.

F. Plain-Steel Wire: ASTM A 1064, as drawn.

G. Deformed-Steel Wire: ASTM A 1064.

H. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064, plain, fabricated from as-drawn steel wire into flat sheets.

I. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064, flat sheet.

J. Galvanized-Steel Welded-Wire Reinforcement: ASTM A 1064, plain, fabricated from galvanized-steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Epoxy-Coated Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, ASTM A 775 epoxy coated.

C. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775.

D. Zinc Repair Material: ASTM A 780.

E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view, where legs of wire bar support contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

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2.5 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C 150,Type I/II.
2. Fly Ash: ASTM C 618, Class F or C.
3. Slag Cement: ASTM C 989, Grade 100 or 120.

C. Normal-Weight Aggregates: ASTM C 33, Class 4S coarse aggregate or better, graded. Provide aggregates from a single source[with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials].

1. Maximum Coarse-Aggregate Size: 1-1/2 inches.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494, Type A.
2. Retarding Admixture: ASTM C 494, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

F. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494, Type C.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Corp. - Construction Chemicals; MasterLife CI 30 (Pre-2014: Rheocrete CNI).
b. Euclid Chemical Company (The); an RPM company; [EUCON BCN][EUCON CIA].
c. GCP Applied Technologies Inc. (formerly Grace Construction Products); DCI.
d. Sika Corporation; Sika CNI.

G. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

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1. Products: Subject to compliance with requirements, provide one of the following:

    a. BASF Corp. - Construction Chemicals; MasterLife CI 222 (Pre-2014: Rheocrete 222+).
    b. GCP Applied Technologies Inc. (formerly Grace Construction Products); DCI-S.
    c. Sika Corporation; FerroGard 901.

H. Water: ASTM C 94 and potable.

2.6 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A 15 mils. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Raven Industries, Inc; Vapor Block 15.
    b. Stego Industries, LLC; Stego Wrap Vapor Barrier (15-Mil).
    c. W.R. Meadows, Inc; Perminator 15 mil.

B. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils thick.

C. Bituminous Vapor Retarder: 110-mil-thick, semiflexible, seven-ply sheet membrane consisting of reinforced core and carrier sheet with fortified asphalt layers, protective weather coating, and removable plastic release liner. Furnish manufacturer's accessories, including bonding asphalt, pointing mastics, and self-adhering joint tape.
1. Water-Vapor Permeance: 0.0011 grains/h x sq. ft. x inches Hg; ASTM E 154.
2. Tensile Strength: 140 lbf/inch; ASTM E 154.
3. Puncture Resistance: 90 lbf; ASTM E 154.

2.7 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. BASF Corp. - Construction Chemicals; Confilm.
    b. ChemMasters, Inc; Spray-Film.
    c. Dayton Superior; AquaFilm J74RTU.
    d. Euclid Chemical Company (The); an RPM company; Eucobar.
    e. Sika Corporation; SikaFilm.
    f. SpecChem, LLC; Spec Film.
    g. W.R. Meadows, Inc; EVAPRE.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

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C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Corp. - Construction Chemicals; MasterKure CC 180 WB (Pre-2014: Kure N Seal VOC).
b. ChemMasters, Inc; Safe-Cure Clear DR.
c. Dayton Superior; Clear Cure VOC J7WB.
d. Euclid Chemical Company (The); an RPM company; Kurez DR VOX.
e. SpecChem, LLC; SpecRez.
f. W.R. Meadows, Inc; 1100-CLEAR SERIES.

F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:

a. ChemMasters, Inc; Polyseal WB.
b. Dayton Superior; Cure & Seal 1315 J22WB.
c. Euclid Chemical Company (The); an RPM company; Super Diamond Clear VOX.
d. SpecChem, LLC; Cure & Seal WB 25.
e. W.R. Meadows, Inc; Vocomp-30.

2.8 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork, or self-expanding cork.

B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

D. Reglets: Fabricate reglets of not less than 0.022-inch-thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

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E. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.9 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109.

2.10 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.
2. Combined Fly Ash and Pozzolan: 25 percent.
3. Slag Cement: 50 percent.

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4. Combined Fly Ash or Pozzolan and Slag Cement: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
5. Silica Fume: 10 percent.
6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
7. Combined Fly Ash or Pozzolans, Slag Cement, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
8. Do not use Fly Ash or Pozzolans, Slag Cement, or Silica Fume in concrete to receive a polished finish.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Concrete mixtures for building elements shall meet the requirements indicated on the drawings.

2.12 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116 and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

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B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch for smooth-formed finished surfaces.
2. Class C, 1/2 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

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I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.
4. No aluminum conduit shall be installed in concrete.
5. No sleeves, holes, or inserts shall be placed in or within 2'-0" of columns or beams without approval of the structural engineer.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete is to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.

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C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORING AND RESHORING INSTALLATION

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.

1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and re-shore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR-RETARDER INSTALLATION

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder according to manufacturer's written instructions.

C. Granular Course: For slabs on ground receiving moisture-sensitive floor covering place slab directly on vapor retarder. Place vapor retarder on granular fill or fine-graded granular material, moisten and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.

D. Thickness of granular fill shall be 6 inch minimum unless noted otherwise in geotechnical report.

3.6 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

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B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Weld reinforcing bars according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

F. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

G. Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material according to ASTM A 780. Use galvanized-steel wire ties to fasten zinc-coated steel reinforcement.

H. Where reinforcement is in top (top 3") of all concrete exposed to freeze-thaw conditions, use epoxy-coated or zinc-coated bars.

3.7 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
6. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

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C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. No concrete shall be placed except when Architect's representative (or independent testing laboratory) is present unless this requirement is specifically waived by the Architect. Give adequate notice to the Architect, the testing laboratory, and all contractors affected before placing concrete.

C. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified. Concrete delivery tickets shall show:

1. Batch number
2. Mix by number with cement content in pounds and maximum size aggregate
3. Admixtures
4. Air content
5. Slump
6. Time of loading
7. Temperature of concrete for mass concrete elements

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D. Discharge concrete within 1-1/2 hours after water has been added to the cement unless a longer time has been authorized by the Architect/Engineer. During hot weather or other conditions contributing to a quick stiffening of the concrete, the Architect/Engineer may require discharge in less than 1-1/2 hours. If loss of slump occurs, HRWR may be re-dosed at the site as long as a "flash set" has not occurred. Re-dosage procedures must be discussed and approved by the Engineer and the manufacturer at the Pre-Concrete Conference.

E. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

F. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

G. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

H. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

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1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete Insert locations.

C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1-part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix 1-part portland cement and 1-part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.

1. Apply scratch finish to surfaces to receive concrete floor toppings or to receive mortar setting beds for bonded cementitious floor finishes.

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C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
    a. For polished slabs: Specified overall values of flatness, SOF(F) 45; and of levelness, SOF(L) 35; with minimum local values of flatness, MLF(F) 27; and of levelness, MLF(L) 21.
    b. For all other slabs: Specified overall values of flatness, SOF(F) 35; and of levelness, SOF(L) 25; with minimum local values of flatness, MLF(F) 21; and of levelness, MLF(L) 15.
3. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

3.11 MISCELLANEOUS CONCRETE ITEM INSTALLATION

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.

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2. Construct concrete bases 4 inches high unless otherwise indicated and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
3. Minimum Compressive Strength: 4000 psi at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place, and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.12 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb./sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

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2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.

    a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

    a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.13 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

    1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

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B. Patching Mortar: Mix dry pack patching mortar, consisting of 1-part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except

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without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.15 FIELD QUALITY CONTROL

A. Special Inspections and field quality control testing: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

1. Refer to drawings for testing and special inspection requirements.

2. Prepare and submit reports within 7 days of completing tests and inspections. Distribute reports to Architect, Engineer, Owner (or owner’s representative), and Contractor. Clearly indicate non-compliance on reports.

B. Non-Compliant Work:

1. The contractor shall remove and replace all non-compliant work, or, at the contractor’s expense, perform additional testing to verify compliance. Contractor shall submit results of additional testing to Architect, Engineer, and Owner (or owner’s representative) for review and approval.

3.16 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 033000

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Mix Design Submittal Form

A copy of this form shall be completed for each type of concrete listed in the specification. Mix designs not submitted on this form will not be reviewed.

Part 1

CONCRETE SUPPLIER INFORMATION

Contact Person: _____

Telephone Number: _____

Company Name: _____

Address: _____

_____

Main Plant Location: _____

Miles from Project Site: _____

PROJECT INFORMATION

Project Name: _____

Address: _____

_____

General Contractor: _____

Concrete Type: _____

Specification Section Reference: _____

Intended Use: _____

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Part 2

DETERMINE REQUIRED COMPRESSIVE STRENGTH (select one method)

☐ If field test data is available:

If a group of at least 15 consecutive compressive strength tests meeting the requirements of ACI 301-10 4.2.3.2 are available, calculate the standard deviation and required average compressive strength from ACI 301-10 Table 4.2.3.3.a

Number of Tests: _____

Standard Deviation: _____

K Factor: _____

f'_{cr}: _____

Recorded Field Test Data		
Test	Date	f'c
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		

☐ If field test data is not available:

If no field compressive strength tests are available, select required average compressive strength from ACI 301-10 Table 4.2.3.3.b

f'_{cr}: _____

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Part 3

DOCUMENTATION OF AVERAGE COMPRESSIVE STRENGTH

Two methods of determining expected compressive strength are acceptable including Field Test Data Method and Trial Mix Method. Select **one** method and provide the data required as described.

Field Test Data Method:

Provide design Materials, Types, Specific Gravity, Weight and Volume for the concrete being tested. Utilize the following table. Mix #2 is not required when ten or more consecutive strength tests for one mixture are available. See ACI 301-10 4.2.3.4.a for additional information and requirements.

Materials	Type/Source		Specific Gravity		Weight (lbs.)		Absolute Volume (cu. ft.)	
Mix	#1	#2	#1	#2	#1	#2	#1	#2
Cement								
Fly Ash								
Microsilica								
Coarse Aggregate								
Fine Aggregate								
Water								
Air								
Other								
TOTAL							27.0 cu. ft.	

Mix #1, Water/Cement Ratio: _____

Mix #2, Water/Cement Ratio: _____

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☐ If at least 10 strength tests represent <u>one</u> mixture, calculate average compressive strength and verify it is greater than required compressive strength.

Average Compressive Strength (f'c): _____

Required Compressive Strength (f'cr): _____

☐ If at least 10 strength tests represent <u>two</u> mixtures, calculate average compressive strength for each mixture and plot as a function of water/cement ratio. Using the required compressive strength from Part 2, determine the corresponding water/cement ratio.

Required Compressive Strength (f'c): _____

Water/Cement Ratio From Plot: _____

Attach copy of average compressive strength vs. water cement ratio.

Establish mixture proportions based upon the required water cementitious ratio. Use the table below to show the actual mixture used on the project. (If one trial mix was used the mixture will match Mix #1)

Field Test Data					
Mix #1	Date	f'c	Mix #2*	Date	f'c
1			1		
2			2		
3			3		
4			4		
5			5		
6			6		
7			7		
8			8		
9			9		
10			10		
11			11		
12			12		
13			13		
14			14		
15			15		
16			16		
17			17		
18			18		
19			19		
20			20		
21			21		
22			22		
23			23		
24			24		
25			25		
26			26		
27			27		
28			28		
29			29		
30			30		
Average	-		Average	-	

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Materials	Type/Source	Specific Gravity	Weight (lbs.)	Absolute Volume (cu. ft.)
Cement				
Fly Ash				
Microsilica				
Coarse Aggregate				
Fine Aggregate				
Water				
Air				
Other				
TOTAL				27.0 cu. ft.

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Trial Mixture Method:

Provide three design mixtures including: Materials, Types, Specific Gravity, Weight and Volume for the concrete being tested. See ACI 301-10 for additional information and requirements.

Materials	Type/Source			Specific Gravity			Weight (lbs.)			Absolute Volume (cu. ft.)		
Trial Mixture	#1	#2	#3	#1	#2	#3	#1	#2	#3	#1	#2	#3
Cement												
Fly Ash												
Microsilica												
Coarse Aggregate												
Fine Aggregate												
Water												
Air												
Other												
Total										27.0 cu. ft.		

Mix #1, Water/Cement Ratio: _____

Mix #2, Water/Cement Ratio: _____

Mix #3, Water/Cement Ratio: _____

Provide compressive test results from above mixtures.

Trial Mix Test Data								
Mix #1	Date	f'c	Mix #2	Date	f'c	Mix #3	Date	f'c
1			1			1		
2			2			2		
3			3			3		
Average	-		Average	-		Average	-	

Plot average compressive strength versus water cement ratio and determine the proper water-cementitious material ratio to meet the required compressive strength from Part 2.

Required Compressive Strength (f'cr): _____

Water/Cementitious Materials Ratio: _____

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Establish the mixture proportions based upon the required water cementitious ratio. Use the table below to summarize mixture proportions used on the project.

Materials	Type/Source	Specific Gravity	Weight (lbs.)	Absolute Volume (cu. ft.)
Cement				
Fly Ash				
Microsilica				
Coarse Aggregate				
Fine Aggregate				
Water				
Air				
Other				
TOTAL				27.0 cu. ft.

Additional Requirements/Information:

Please provide the following attachments: (Initial if attached)

Coarse Aggregate Gradation Report _____

Fine Aggregate Gradation Report _____

Concrete Compressive Strength Data _____

Admixture Compatibility Certification Letter _____

Trial Mixture strength vs. water/cement ratio plots _____

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SECTION 03 35 11 - CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Clear coatings.

1.2 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Field-applied joint sealants.

B. Section 09 05 61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and concrete slab flatness and levelness requirements.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

B. Coordinate the work with concrete floor placement and concrete floor curing.

C. For slabs indicated to receive concrete polishing system, do not proceed with concrete polishing unless manufacturer's representative and specialized equipment is present for every day of placement.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.

1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.

2. Manufacturer's Information: Technical information, including label analysis and instructions for handling, storing, and applying each coating material.

C. Manufacturer's Instructions: Indicate manufacturer's installation instructions for preparation of substrate, application of finishing products, and requirements for polishing and protection of finished surface.

D. Installer's qualification statement.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of type specified and with at least five (5) years of documented experience and approved by manufacturer.

B. Source Limitations: Obtain products for each coating system from the same manufacturer as the finish coats; produced by single manufacturer and obtained from single supplier.

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1.6 MOCK-UPS

A. For each type of concrete floor finishing system, construct mock-up area under conditions similar to those that will exist during application, with coatings applied.

B. Construct mock-ups of each exposed concrete floor finish indicated on drawings, nominally 10 feet square.

C. Locate where directed.

D. Approved mock-up(s) may remain as part of the work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's sealed packaging, and containers bearing manufacturer's name and label, including application instructions, and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain storage containers in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.8 FIELD CONDITIONS

A. Maintain light level equivalent to a minimum 200 W light source at 8 feet above the floor surface over each 20 foot square area of floor being finished.

B. Do not finish floors until interior heating system is operational.

C. Maintain ambient temperature of 50 degrees F minimum.

D. Close areas to traffic during finish system application and, after application, for time period recommended in writing by manufacturer.

PART 2 PRODUCTS

2.1 APPLICATIONS

A. Clear Coating:

1. Use at the following locations: Interior floor finish tagged with "CONC".

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2.2 COATINGS

A. Clear Coatings: Clear coating recommended by manufacturer for finishing concrete floors and slabs.

1. Gloss: High gloss.
2. Color(s): None; clear.
3. Type: High solids polyurethane; two-component.
    a. Products:
        1) (Basis of Design) H&C Products Group; H&C Pro Series Water-Based Polyurethane 2-Part Clear: www.hcconcrete.com.
        2) SureCrete Design Products; Dura-Kote DK 400WB: www.surecretedesign.com.

PART 3 EXECUTION

3.1 CURING OF CONCRETE SLAB

A. See Section 03 30 00.

3.2 EXAMINATION

A. Verify that floor surfaces are acceptable to receive the work of this section.

B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes; allow complete curing of concrete slab before application of finishes.

C. Verify that substrates are ready for finish 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 floor finish manufacturer.
3. Follow moisture and alkalinity remediation procedures in Section 09 05 61.

D. Verify that required floor-mounted utilities are in correct location.

3.3 PREPARATION

A. Remove slab ridges and bumps.

B. Vacuum clean substrate.

C. Apply concrete sealers, densifiers-hardeners only to clean, bare concrete.

3.4 GENERAL

A. Apply materials in accordance with manufacturer's instructions.

3.5 DENSIFIER-HARDENER APPLICATION

A. Apply densifier and hardener at specified rates and intervals.

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1. Apply a heavy saturation on floors, using low-pressure spray equipment, roller, or brush. Do not use airless spray.
2. Saturate the surface so that the entire surface is wet.
3. Scrub liquid into surface until a gel forms; rewet and repeat broom-sweeping or scrubbing.
4. After 30 to 40 minutes comply with one of the following:
    a. If the majority of sealer has been absorbed into the surface, broom-sweep or squeegee any excess material from all low spots and puddles so that it will be absorbed into the surface also, or removed from the surface.
    b. If the majority of sealer is still on the surface, wait until it becomes slippery underfoot, then flush the entire surface with clear water and squeegee completely dry.
5. Rinse with water; remove excess material until surface is dry.
6. Apply a second coat in a similar manner if surface is rough or porous.

B. Saturate concrete surface with liquid floor treatment; respray or broom excess onto dry spots.

C. Keep surface wet with liquid floor treatment for a minimum soak-in period of 30–40 minutes.
1. If most of the material has been absorbed after the 30 minute soak-in period, remove all excess material, especially from low spots, using broom or squeegee.
2. If most of the material remains on the surface after the 30 minute soak-in period, wait until the surface becomes slippery and then flush with water, removing all residue. Squeegee completely dry, flushing any remaining slippery areas until no residue remains.

D. Clean spills on slab surfaces immediately, with manufacturer's recommended chemicals and absorptive materials.

E. No haze, white residue, streaking, or burnish marks permitted.

3.6 COATING APPLICATION

A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.

B. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.

C. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

3.7 PROTECTION

A. Protect installed coatings from subsequent construction operations.
1. Protect installed floors for at least 3 months until densifier and hardener's chemical reaction process is complete.
2. Do not allow parking of vehicles on concrete floors.

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3. Do not allow pipe cutting using pipe cutting machinery on concrete floors.
4. Do not allow temporary placement and storage of steel members on concrete floors.

B. Do not permit traffic over unprotected floor surface.

C. Clean floors in accordance with concrete floor finish manufacturer's recommendations.

END OF SECTION

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SECTION 04 01 00 - MAINTENANCE OF MASONRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Water and Chemical cleaning of efflorescence and stained masonry surfaces.

B. Repointing mortar joints.

C. Repair of damaged masonry.

1.2 RELATED REQUIREMENTS

A. Section 02 41 19 - Selective Demolition: Salvaging existing unit masonry.

B. Section 04 20 00 - Unit Masonry: Brick and Block masonry units.

C. Section 04 20 00 - Unit Masonry: Mortar and grout.

1.3 PRICE AND PAYMENT PROCEDURES

A. Unit Prices:

1. See Section 01 22 00 - Unit Prices, for additional unit price requirements.

2. Repointing: By the square foot.

B. Alternates:

1. See Section 01 23 00 - Alternates for alternates affecting this section.

a. Alternate No. A-2 - Cleaning of Exterior Face Brick Masonry.

1.4 REFERENCE STANDARDS

A. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2017.

B. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

1.5 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene not less than one week prior to commencing work of this section.

1. Require attendance of parties directly affecting work of this section.

2. Review conditions of installation, installation procedures, and coordination with related work.

1.6 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on cleaning compounds and cleaning solutions.

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C. Manufacturer's Instructions: For cleaning materials, indicate special procedures, conditions requiring special attention.

1.7 QUALITY ASSURANCE - MASONRY WORK

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

1.8 MOCK-UPS

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Restore and repoint an existing masonry wall area, nominally sized 4 feet long by 4 feet high; include in mock-up area instances of mortar and damaged masonry replaced with replacement materials matching existing.

1. Prepare mockups of unit masonry repair and repointing to demonstrate aesthetic effects and to set quality standards for materials and execution.

2. Clean a 4 ft by 4 ft panel of wall to determine extent of cleaning.

a. Repeat, using different cleaning methods for up to three different panels.

3. Locate where directed.

C. Acceptable mock-up and procedures employed will become the standard for work of this section.

D. Approval of mock-up does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

E. Accepted mock-up may remain as part of the Work.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store restoration cleaner materials in manufacturer's packaging.

1.10 FIELD CONDITIONS - MASONRY WORK

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

B. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.

C. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Restoration and Cleaning Chemicals:

1. Diedrich Technologies, Inc: www.diedrichtechnologies.com.

2. HMK Stone Care System: www.hmkstonecare.com.

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3. PROSOCO: www.prosoco.com.
4. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 CLEANING MATERIALS

A. Cleaning Agent: Manufacturer's recommended proprietary type(s).
1. Paint Remover:
a. (Basis-of-Design) PROSOCO, Inc; Enviro Klean SafStrip.
2. Cleaner:
a. (Basis-of-Design) PROSOCO; Sure Klean ReVeal.

2.3 MORTAR MATERIALS

A. Comply with requirements of Section 04 20 00.

2.4 MASONRY MATERIALS

A. Brick: Comply with requirements of Section 04 20 00.

2.5 MASONRY ACCESSORIES

A. Flashing, Joint Fillers, Weep/Vent Products: Section 04 20 00.

2.6 JOINT SEALANTS

A. Elastomeric Joint Sealant: Section 07 62 00.

PART 3 EXECUTION

3.1 GENERAL

A. Comply with procedures recommended in BIA Technical Notes No. 46.

3.2 EXAMINATION

A. Verify that surfaces to be cleaned and tuck-pointed are ready for work of this section.

3.3 PREPARATION

A. Protect surrounding elements from damage due to restoration procedures.
B. Carefully remove and store removable items located in areas to be restored, including fixtures, fittings, finish hardware, and accessories; reinstall upon completion.
C. Separate areas to be protected from restoration areas using means adequate to prevent damage.
D. Cover existing landscaping with tarpaulins or similar covers.
E. Mask immediately adjacent surfaces with material that will withstand cleaning and restoration procedures.

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F. When using cleaning methods that involve water or other liquids, install drainage devices to prevent runoff over adjacent surfaces unless those surfaces are impervious to damage from runoff.

G. Do not allow cleaning runoff to drain into sanitary or storm sewers.

3.4 REBUILDING

A. Cut out damaged and deteriorated masonry with care in a manner to prevent damage to any adjacent remaining materials.

B. Support structure as necessary in advance of cutting out units.

C. Cut away loose or unsound adjoining masonry, mortar, and stone to provide firm and solid bearing for new work.

D. Build in new units following procedures for new work specified in other section(s).

E. Mortar Mix: Colored and proportioned to match existing work.

F. Ensure that anchors, ties, reinforcing, and flashings are correctly located and built in.

G. Install built in masonry and cast stone work to match and align with existing, with joints and coursing true and level, faces plumb and in line. Build in all openings, accessories and fittings.

3.5 REPOINTING

A. Perform repointing prior to cleaning masonry surfaces.

B. Cut out loose or disintegrated mortar in joints to minimum 3/4 inch depth, twice the joint width, or until sound mortar is reached whichever is greater.

1. Remove all loose and unstable mortar in the joints.

2. Do not damage the brick substrate or overcut the joints during mortar removal.

C. Use power tools only after test cuts determine no damage to masonry units will result.

D. Do not damage masonry units.

E. When cutting is complete, remove dust and loose material by brushing.

F. Premoisten joint and apply mortar. Pack the joints with mortar to fill voids up to the pointing depth. Pack tightly in maximum 1/4 inch layers, installing subsequent lifts only after each layer of mortar becomes thumbprint hard. Form a smooth, compact concave joint with profile to match existing.

G. Moist cure for 72 hours.

3.6 CLEANING NEW MASONRY

A. Verify mortar is fully set and cured.

B. As work progresses clean surfaces and remove large particles with wood scrapers, brass or nylon wire brushes.

C. If required to restore appearance; scrub walls with cleaning agent solution using stiff brush. Do not scrub the mortar joints. Thoroughly rinse and wash off cleaning solution, dirt and mortar crumbs using clean, pressurized water.

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3.7 RESTORATION CLEANING

A. Clean surfaces and remove large particles with wood scrapers or non-ferrous wire brush.

B. Wet surface with cold water applied by low-pressure spray.

C. Spray coat existing face brick type masonry with restoration cleaner, mixed into solution in accordance with manufacturer's instructions.

D. Allow sufficient time for solution to remain on masonry and agitate with soft fiber brush or sponge.

E. Apply a second coat of cleaner; repeat steps above.

F. Rinse from the bottom up with potable water applied at 400 psi and at a rate of 4 gal/min.

3.8 CLEANING

A. Immediately remove stains, efflorescence, or other excess resulting from the work of this section.

B. Remove excess mortar, smears, and droppings as work proceeds and upon completion.

C. Clean surrounding surfaces.

END OF SECTION

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SECTION 04 20 00 - UNIT MASONRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete block.

B. Installation of salvaged face brick.

C. Mortar and grout.

D. Reinforcement and anchorage.

E. Flashings.

F. Lintels.

G. Accessories.

1.2 RELATED REQUIREMENTS

A. Requirements on Structural Drawings.

B. Section 05 50 00 - Metal Fabrications: Loose steel lintels.

C. Section 07 62 00 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.

D. Section 07 92 00 - Joint Sealants: Sealing control joints.

1.3 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2025.

C. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2022.

D. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2024.

E. ASTM C90 - Standard Specification for Dry-Cast Loadbearing Concrete Masonry Units; 2024a.

F. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2025.

G. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.

H. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2024.

I. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2025a.

J. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2024.

K. ASTM C476 - Standard Specification for Grout for Masonry; 2023.

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L. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2024.

M. ASTM C1072 - Standard Test Methods for Measurement of Masonry Flexural Bond Strength; 2022.

N. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2024.

O. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry; 2020.

P. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.

Q. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls; 2017.

R. BIA Technical Notes No. 28B - Brick Veneer/Cold-Formed Steel Framed Walls; 2025.

S. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2017.

T. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for masonry units, reinforcement, mortar, grout, flashing, and masonry accessories.

C. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

D. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.

1.5 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

1.6 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards, requirements indicated on Structural Drawings, and the following:

1. Integral Water Repellent: Concrete block units as specified in this section with polymeric liquid or powder admixture added to concrete masonry units at time of manufacture. For use in CMU assemblies that are below-grade or part of the building envelope.

a. Performance of Units with Integral Water Repellent:

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1) Water Permeance: When tested per ASTM E514/E514M and for a minimum of 72 hours.
   (a) No water visible on back of wall above flashing at the end of 24 hours.
   (b) No flow of water from flashing equal to or greater than 0.032 gallons per hour at the end of 24 hours.
   (c) No more than 25 percent of wall area above flashing visibly damp at end of test.
2) Flexural Bond Strength: ASTM C1072; minimum 10 percent increase.
3) Compressive Strength: ASTM C1314; maximum 5 percent decrease.

b. Use in combination with mortar that also has integral water repellent admixture.
c. Use water repellent admixtures for masonry units and mortar by a single manufacturer.

2. (MAS-1) Insulated CMU - Special Units with Factory- or Site-Installed Insulation Inserts: ASTM C90, normal weight.
   a. Type: Special shape without end webs, with offset cross webs to minimize thermal bridging, and with two rows of internal cells for continuous insulation inserts.
   b. U-Factor: Insulated CMU thermal envelope shall have a U-factor no greater than that indicated for climate zone 5, above-grade mass walls in OECC Table C402.1.4, as indicated below.
      1) U-0.090, maximum.
   c. Insulation Type: Manufacturer's standard expanded polystyrene (EPS).
   d. Exposed Faces, Color and Texture:
      1) Texture: **Ground Face,** ~~**Burnished,**~~ as manufactured by Westbrook Concrete Block Co., Inc
      2) Color: ~~**To be selected from manufacturer's full range.**~~ **Basis of Design: Westbrook Concrete Block Co., Inc #GF-320.**
   e. Manufacturers:
      1) The Concrete Products Group: www.concreteproductsgroup.com.
      2) Omni Block, Inc: www.omniblock.com.
      3) Westbrook Concrete Block Co., Inc.

2.2 BRICK UNITS

A. (MAS-2) Face Brick: Existing brick salvaged from demolition.

2.3 MORTAR AND GROUT MATERIALS

A. Masonry Cement: (ASTM C91/C91M) Not permitted.
B. Portland Cement: ASTM C150/C150M, Type I.

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1. Not more than 0.60 percent alkali.

C. Hydrated Lime: ASTM C207, Type S.

D. Mortar Aggregate: ASTM C144.

E. Grout Aggregate: ASTM C404.

F. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.

1. Color(s): As selected by Architect from manufacturer's full range.

2. Manufacturers:

a. Davis Colors, a division of Venator Materials PLC: www.daviscolors.com.

b. Lambert Corporation: www.lambertusa.com.

c. Solomon Colors, Inc: www.solomoncolors.com.

G. Water: Clean and potable.

H. Integral Water Repellent Admixture for Mortar: Polymeric liquid admixture added to mortar at the time of manufacture. For use in unit masonry construction that is below-grade or part of the building envelope.

1. Use only in combination with masonry units manufactured with integral water repellent admixture.

2. Use only water repellent admixture for mortar from the same manufacturer as water repellent admixture in masonry units.

3. Meet or exceed performance specified for water repellent admixture used in masonry units.

I. Packaged Dry Material for Mortar for Repointing: Premixed Portland cement, hydrated lime, and graded sand; capable of producing Type O mortar in accordance with ASTM C270 with the addition of water only.

1. Color: To match existing mortar color.

2.4 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Steel: ASTM A615/A615M, Grade and Type as specified on Structural drawings.

B. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

C. Single Wythe Joint Reinforcement: ASTM A951/A951M.

1. Type: Ladder.

2. Material: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M Class B.

3. Size: Side rods and cross rods, diameter as on Structural drawings; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.

D. Multiple Wythe Joint Reinforcement: ASTM A951/A951M.

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1. Material: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M Class B.

E. Adjustable Multiple Wythe Joint Reinforcement: ASTM A951/A951M.

1. Material: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M Class B.

F. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.

1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup.
2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
3. Vertical adjustment: Not less than 3-1/2 inches.

2.5 FLASHINGS

A. Metal Flashing Materials: Stainless Steel, as specified in Section 07 62 00.

B. Membrane Non-Asphaltic Flashing Materials:

1. Composite Polymer Flashings - Self-Adhering: Composite polyethylene, PVC, or KEE membrane; 40 mil thick with pressure-sensitive butyl or other non-asphaltic adhesive and release paper.
    a. Manufacturers:
        1) 3GEN Masonry Products; GENFLASH: www.3genmp.com.
        2) Hohmann & Barnard, Inc; Textroflash: www.h-b.com.
        3) WIRE-BOND; MAS-N-FLASH S.A.: www.wirebond.com.
        4) York Flashings; Wicked Good Flashing: www.yorkflashings.com.

C. Termination Bars: Polyvinyl chloride (PVC); compatible with membrane and adhesives.

D. Drip Edge: Stainless steel; compatible with membrane and adhesives. Provide the following configurations indicated.

1. Base of Wall: Flat flush drip with hemmed edge.
2. Lintels and Shelf Angles: Angled projecting drip with hemmed edge.

E. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

2.6 ACCESSORIES

A. Preformed Control Joints: Rubber or PVC material. Provide with corner and tee accessories, fused joints.

B. Weeps and Vents:

1. Type: Extruded propylene with honeycomb design.
2. Color(s): As selected by Architect from manufacturer's full range.

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2.7 LINTELS

A. Steel Lintels: Provide shapes indicated on drawings; specified in Section 05 50 00.

2.8 MORTAR AND GROUT MIXING

A. Mortar for Unit Masonry: ASTM C270, using the Property Specification.
   1. Masonry below grade and in contact with earth: Type S.
   2. Exterior, loadbearing masonry: Type M or S.
   3. Exterior, non-loadbearing masonry: Type N.
   4. Interior, loadbearing masonry: Type M or S.
   5. Interior, non-loadbearing masonry: Type O.

B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.
   1. Provide colored mortar at all new masonry exposed to view.

C. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

D. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.

PART 3 EXECUTION

3.1 EXAMINATION

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

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

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

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.3 COLD AND HOT WEATHER REQUIREMENTS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

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3.4 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:

1. Bond: Running.

2. Coursing: One unit and one mortar joint to equal 8 inches.

3. Mortar Joints: Concave.

D. Brick Units:

1. Match existing bond pattern, coursing, and mortar joint profile.

3.5 PLACING AND BONDING

A. Lay hollow masonry units with face shell bedding on head and bed joints.

B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

C. Remove excess mortar and mortar smears as work progresses.

D. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.

E. Interlock intersections and external corners.

F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

H. Isolate top joint of non-loadbearing masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.6 WEEPS/CAVITY VENTS

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

B. Install cavity vents in veneer and cavity walls at 32 inches on center horizontally below shelf angles and lintels and near top of walls.

3.7 REINFORCEMENT AND ANCHORAGE

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

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D. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch mortar cover on each side.

E. Lap joint reinforcement ends minimum 6 inches.

3.8 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

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

3.9 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.

B. Terminate flashing up 8 inches minimum on vertical surface of backing:

1. Install vertical leg of flashing over fluid-applied or self-adhered air/vapor barriers over backing or per manufacturer’s directions.

2. Anchor vertical leg of self-adhered flexible flashing into backing with a termination bar and sealant.

a. Apply cap bead of sealant on top edge of self-adhered flashing termination bar.

C. Install flashing in accordance with manufacturer's instructions.

D. Support flexible flashings across gaps and openings.

E. Extend self-adhered flexible flashings to within 1/2 inch of exterior face of masonry and adhere to top of stainless steel drip with a hemmed edge.

F. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

3.10 LINTELS

A. Install loose steel lintels over openings; comply with requirements indicated on Structural Drawings.

B. Maintain minimum 6 inch bearing on each side of opening.

3.11 GROUTED COMPONENTS

A. Reinforce bond beams as indicated on Structural drawings.

B. Lap splices as indicated on Structural drawings.

C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

D. Place and consolidate grout fill without displacing reinforcing.

1. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.

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3.12 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

C. Size control joints as indicated on drawings; if not indicated, 3/4 inch wide and deep.

3.13 BUILT-IN WORK

A. As work progresses, install built-in fabricated metal frames and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Do not build into masonry construction organic materials that are subject to deterioration.

3.14 TOLERANCES

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

B. Maximum Variation from Alignment of Columns and Pilasters: 1/4 inch.

C. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

D. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

E. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

F. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

G. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

H. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.15 CUTTING AND FITTING

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

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.16 FIELD QUALITY CONTROL

A. Owner's independent testing agency will perform field quality control tests, as specified in Division 01 Sections, and indicated on Structural Drawings, includes the following:

1. Masonry mortar design and strength
2. Masonry grout design and strength
3. Masonry prism strength
4. Concrete masonry unit acceptance
5. Exterior block acceptance

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B. Tests and Inspections: Refer to Structural Drawings.

3.17 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.18 PROTECTION

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

END OF SECTION

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SECTION 05 05 13 - SHOP-APPLIED COATINGS FOR METAL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. (MTL-1, MTL-2, MTL-3) Metal finishes.

1.2 RELATED REQUIREMENTS

A. Section 07 61 13 - Standing Seam Sheet Metal Roofing and Wall Cladding.

B. Section 07 62 00 - Sheet Metal Flashing and Trim.

C. Section 07 71 00 - Roof Specialties.

D. Section 07 71 23 - Manufactured Gutters and Downspouts.

E. Section 07 72 00 - Roof Accessories.

F. Section 08 43 13 - Aluminum-Framed Entrances and Storefronts.

G. Section 08 44 13 - Glazed Aluminum Curtain Walls.

1.3 REFERENCE STANDARDS

A. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum; 2025.

B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

C. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates; 2025.

D. ASTM D4145 - Standard Test Method for Coating Flexibility of Prepainted Sheet; 2010 (Reapproved 2022).

E. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films; 2023.

F. NAAMM AMP 500-06 - Metal Finishes Manual; 2006.

1.4 SUBMITTALS

A. Selection Samples: For each finish product specified, submit at least three sample color chips representing manufacturer's full range of available colors and patterns.

B. Verification Samples: For each finish product specified, submit at least three samples, minimum size 12 inch square, and representing actual product in color and texture.

C. Certificate: Certify that products of this section meet or exceed specified requirements.

D. Maintenance Data: Care of factory-applied finishes and warranty requirements.

E. Executed warranty.

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1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with AAMA 609 & 610 for protection, storage, and handling of factory finished metal.

B. Protect items from damage during handling and transportation.

1.6 WARRANTY

A. Sheet Metal Finish Warranty: Provide manufacturer warranty against excessive degradation of exterior finishes. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.

b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.

c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 20-years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Comply with NAAMM AMP 500-06.

B. Apply organic finishes to metal after fabrication unless otherwise indicated.

C. Limit variations in appearance of adjacent pieces to one-half of range represented in approved samples. Noticeable variations in same piece are not acceptable. Install components within range of approved samples to minimize contrast.

2.2 ANODIZED FINISHES (MTL-3)

A. Class I Color Anodized Finish: Exterior storefront and curtain wall; comply with one of the following:

1. AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils thick.

2. AAMA 611 AA-M12C22A44 Electrolytically deposited colored anodic coating not less than 0.7 mils thick.

B. Class II Color Anodized Finish: Interior storefront; comply with one of the following:

1. AAMA 611 AA-M12C22A32 Integrally colored anodic coating not less than 0.4 mils thick.

2. AAMA 611 AA-M12C22A34 Electrolytically deposited colored anodic coating not less than 0.4 mils thick.

2.3 SHEET METAL FINISHES (MTL-1, MTL-2, MTL-3)

A. General: Subject to compliance with requirements, use either of the factory-applied superior performing organic coating systems specified under this article.

1. Coating Flexibility: Pass ASTM D4145 minimum 1T Bend at time of manufacturing.

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2. Long-Term Performance: Not less than that specified under WARRANTY in PART 1.

B. Fluoroethylene Vinyl Ether (FEVE) Coating: Superior performing resin based organic powder coatings system complying with AAMA 2605; single coat applications when applied to aluminum with dry film thickness (DFT) of 2 to 3 mil, 0.002 to 0.003 inch; color and gloss as scheduled.

C. Polyvinylidene Difluoride (PVDF) Coating: Multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch; color and gloss as scheduled.

2.4 COLOR

A. General: Match basis of design color indicated as selected by Architect from manufacturer's full range, unless otherwise indicated.

B. MTL-1: As specified in Section 01 23 00 and 07 61 13 and complying with one of the following:

1. Provide product specified.

2. Provide custom color match subject to review and approval by Architect during the bidding period.

C. MTL-2: Alucobond, New-Age Dark Bronze Mica.

D. MTL-3: Dark bronze anodized; Metal Era 'Midnight (Extra Dark) Bronze'

2.5 ACCESSORIES

A. Touch-Up Materials: As recommended by coating manufacturer for field application.

PART 3 EXECUTION

3.1 INSTALLATION

A. Factory apply coating to exposed metal surfaces with proper preparation and pretreatment in accordance with resin manufacturer's instructions.

3.2 REPAIR

A. Field Repairs to Finishes: Using materials and methods sufficient that repairs are not discernible when viewed at distance of 10 feet under typical light conditions experienced at project.

3.3 CLEANING

A. Restore finishes damaged during installation and construction period. Return items that cannot be refinished in the field to manufacturer or fabricator. Refinish entire unit or provide new units.

B. Remove protective film after installation of joint sealers, after cleaning of adjacent materials, and immediately prior to completion of work.

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C. Clean installed products in accordance with manufacturer's instructions.

END OF SECTION

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SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural steel.
2. Shrinkage-resistant grout.
3. Other Steel: shelf angles, relieving angles, loose lintels, beam lintels.
4. Steel joist bearing plates.

B. Related Requirements:

1. Section 053100 "Steel Decking" for field installation of shear stud connectors through deck.
2. Section 055000 "Metal Fabrications" for miscellaneous steel fabrications and other steel items not defined as structural steel.
3. Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" and Section 099600 "High-Performance Coatings" for painting requirements.

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

C. Shop Drawings: Show fabrication of structural-steel components.

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1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
5. Identify members and connections of the seismic-load-resisting system.
6. Indicate locations and dimensions of protected zones.
7. Identify demand-critical welds.
8. Identify members not to be shop primed.

D. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide in accordance with AWS D1.1/D1.1M for each welded joint whether prequalified or qualified by testing, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand-critical welds.

E. Delegated Design Submittal: For structural-steel connections indicated on Drawings to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Submittal of structural analysis data is not required for typical AISC-recommended simple shear connections.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, fabricator, shop-painting applicators, and professional engineer.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural-steel materials, including chemical and physical properties.

E. Product Test Reports: For the following:

1. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shear stud connectors.

F. Survey of existing conditions.

G. Source quality-control reports.

H. Field quality-control reports.

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1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).

B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

C. Shop-Painting Applicators: Qualified in accordance with AISC's Sophisticated Paint Endorsement (SPE) or to SSPC-QP 3.

D. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

E. Special Inspector Qualifications: A qualified person employed or retained by an approved agency that has the recommended experience and certifications as summarized in Appendix C of the current International Code Council (ICC) Special Inspection Manual.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

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PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with applicable provisions of the following specifications and documents:

1. ANSI/AISC 303.
2. ANSI/AISC 341.
3. ANSI/AISC 360.
4. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

B. Connection Design Information:

1. For simple shear connections: Fabricator's experienced steel detailer shall select or complete connections in accordance with ANSI/AISC 303.

    a. Select and complete connections using schematic details indicated and ANSI/AISC 360.
    b. Use Allowable Stress Design; data are given at service-load level.

2. For complex connections and connections indicated to comply with design loads: Design connections and final configuration of member reinforcement at connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer.

    a. Use Allowable Stress Design; data are given at service-load level.
    b. Unless noted otherwise on design drawings, design and provide stiffeners, doubler plates, etc., in connections where needed.

C. Engineering Responsibility: Fabricator's responsibilities include using a qualified professional engineer to prepare structural analysis data for structural-steel connections.

D. Moment Connections: Type FR, fully restrained.

E. Construction: Moment frame

2.2 STRUCTURAL-STEEL MATERIALS

A. W- and WT- Shapes: ASTM A572/A572M, Grade 50.

B. Channels, Angles, M-Shapes, S-Shapes: ASTM A36/A36M.

C. Plate and Bar: ASTM A36/A36M.

D. W-, WT-, C-, and MC- Shapes: ASTM A992, Grade 50.

E. M-, S-, L- Shapes: ASTM A572, Grade 50.

F. Plate and Bar: ASTM A572, Grade 50.

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G. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade C structural tubing.

H. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts or Grade F1852 tension-control, bolt-nut-washer assemblies with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1, compressible-washer type with plain finish.

B. High-Strength A490 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A490, Type 1, heavy-hex steel structural bolts ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F959/F959M, Type 490-1, compressible-washer type with plain finish.

C. Zinc-Coated High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

1. Finish: Hot-dip zinc coating.
2. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1, compressible-washer type with mechanically deposited zinc coating finish.

2.4 RODS

A. Unheaded Anchor Rods: ASTM F1554, Grade 55, weldable.

1. Configuration: Straight.
2. Nuts: ASTM A563 heavy-hex carbon steel.
3. Plate Washers: ASTM A36/A36M carbon steel.
4. Washers: ASTM F436, Type 1, hardened carbon steel.
5. Finish: Plain

B. Headed Anchor Rods: ASTM F1554, Grade 55, weldable, straight.

1. Nuts: ASTM A563 hex carbon steel.
2. Plate Washers: ASTM A36/A36M carbon steel.
3. Washers: ASTM F436, Type 1, hardened carbon steel.
4. Finish: Plain.

C. Threaded Rods: ASTM A572/A572M, Grade 50.

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1. Nuts: ASTM A63 hex carbon steel.
2. Washers: ASTM F436, Type 1, hardened carbon steel.
3. Finish: plain.

2.5 PRIMER

A. Steel Primer:

1. Interior Steel Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
2. Galvanizing Repair Paint: ASTM A780/A780M.

2.6 SHRINKAGE-RESISTANT GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.7 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with SSPC-SP 2.

F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

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1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.
4. Expansion and Control Joints: Provide expansion joints in steel shelf angles when part of structural steel frame; locate at vertical masonry expansion joints as indicated on drawings. The gap between ends of angles shall equal the width of the masonry expansion joint. The angles shall have support within 8” of the joints. Provide mitered and welded units at corners.

2.8 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

1. Joint Type: Pretensioned.

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

C. Design of Connections: Typical AISC connections are to be used except where otherwise shown. Details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site whenever possible without causing delay in the work. Promptly notify Architect whenever design of members and connections for any portion of structure are not clearly indicated.

2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize:
   a. Lintels, beam lintels, and shelf angles located in exterior walls.
   b. All exterior steel unless specifically noted on drawings.
3. All welded assemblies to be galvanized shall be prepared according to Recommended Practice for Providing High Quality Zinc Coatings (Hot-Dip) on Assembled Products (ASTM A 385).

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2.10 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces.
6. Corrosion-resisting (weathering) steel surfaces.

B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:

1. For interior steel not exposed to view: SSPC-SP 3.
2. For exterior steel, interior steel exposed to view,: SSPC-SP 6 (WAB)/NACE WAB-3.
3. For exterior steel, interior steel exposed to view,: SSPC-SP 10 (WAB)/NACE WAB-2.
4. For steel to be hot-dipped galvanized: SSPC-SP 8.

C. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.11 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.

1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
2. Bolted Connections: Inspect and test shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

    a. Liquid Penetrant Inspection: ASTM E165/E165M.
    b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
    c. Ultrasonic Inspection: ASTM E164.
    d. Radiographic Inspection: ASTM E94/E94M.

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4. In addition to visual inspection, test and inspect shop-welded shear stud connectors in accordance with requirements in AWS D1.1/D1.1M for stud welding and as follows:

    a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear stud connector.
    b. Conduct tests in accordance with requirements in AWS D1.1/D1.1M on additional shear stud connectors if weld fracture occurs on shear stud connectors already tested.

5. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.

1. Do not remove temporary shoring supporting composite deck construction and structural-steel framing until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

B. Baseplates, Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.

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2. Weld plate washers to top of baseplate.
3. Pretension anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.

C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Do not use thermal cutting during erection.

F. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.

1. Joint Type: Pretensioned.

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

3.5 REPAIR

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.

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B. Touchup Painting:

1. Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

2. Cleaning and touchup painting are specified in Section 099113 "Exterior Painting." Section 099123 "Interior Painting

3. Retain "Touchup Priming" Paragraph below if touchup painting is required for Project but is not part of the Work of this Section.

C. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."

3.6 FIELD QUALITY CONTROL

A. Special Inspections and field quality control testing: Owner will engage a qualified special inspector to perform field tests and inspections and prepare test reports.

1. Refer to drawings for testing and special inspection requirements.
2. Prepare and submit reports within 7 days of completing tests and inspections. Distribute reports to Architect, Engineer, Owner (or owner's representative), and Contractor. Clearly indicate non-compliance on reports.

B. Non-Compliant Work:

1. The contractor shall remove and replace all non-compliant work, or, at the contractor's expense, perform additional testing to verify compliance. Contractor shall submit results of additional testing to Architect, Engineer, and Owner (or owner's representative) for review and approval.

END OF SECTION

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SECTION 05 21 00 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. K-series steel joists.
2. Steel joist accessories.

B. Related Requirements:

1. Section 042000 "Unit Masonry" for installing bearing plates in unit masonry.
2. Section 051200 "Structural Steel Framing" for field-welded shear connectors.
3. Section 051200 “Structural Steel Framing” for furnishing bearing plates and anchors to be set in concrete and masonry.

1.2 DEFINITIONS

A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of joist, accessory, and product.

B. Shop Drawings:

1. Include layout, designation, number, type, location, and spacing of joists.
2. Include joining and anchorage details; bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
3. Indicate locations and details of bearing plates to be embedded in other construction.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Welding certificates.

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C. Manufacturer certificates. Signed by manufacturers certifying that joists comply with requirements.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

E. Mill Certificates: For each type of bolt. Signed by manufacturers certifying that joists comply with requirements.

F. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

G. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications

1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

2. Professional Engineer Qualifications: A professional engineer who is legally authorized to practices 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 installation of joists that are similar to those indicated for this Project in material, design, and extent.

B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Special Inspector Qualifications: A qualified person employed or retained by an approved agency that has the recommended experience and certifications as summarized in Appendix C of the current International Code Council (ICC) Special Inspection Manual.

D. SJI Specifications: Comply with standard specifications in SJI's "Specifications" that are applicable to types of joists indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

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1.7 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated on Drawings.

1. Use ASD; data are given at service-load level
2. Design special joists to withstand design loads with live-load deflections no greater than the following:
    a. Roof Joists: Vertical deflection of 1/360 of the span.

1.8 STEEL JOISTS

A. K-Series Steel Joist: Manufactured steel joists of type indicated according to "Standard Specification for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.

1. Joist Type: K-series steel joists
2. K-Series Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.
3. Provide holes in chord members for connecting and securing other construction to joists. Reduce joist load-carrying capacity proportionately to reduction in chord area.
4. Top-Chord Extensions: Extend top chords of joists with SJI's Type S, top-chord extensions when indicated on Drawings, complying with SJI's "Specifications."
5. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends when indicated on Drawings, complying with SJI's "Specifications."
6. Do not camber joists.
7. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.
8. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

1.9 PRIMERS

A. Primer:

1. SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.
2. Provide shop primer that complies with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1.10 STEEL JOIST ACCESSORIES

A. Bridging:

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1. Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.
2. Schematically indicated. Detail and fabricate according to SJI's "Specifications] Furnish additional erection bridging if required for stability.

B. Fabricate steel bearing plates from ASTM A36/A36M steel with integral anchorages of sizes and thicknesses indicated on Drawings. Shop prime paint

C. Steel bearing plates with integral anchorages are specified in Section 051200 "Structural Steel Framing".

D. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction.

1. Extend ends to within 1/2 inch of finished wall surface unless otherwise indicated on Drawings.
2. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C
3. Retain "High-Strength Bolts, Nuts, and Washers" Paragraph below if splicing of long-span joists or if permanent bolted connections of joist ends using high-strength bolts is required.

E. High-Strength Bolts, Nuts, and Washers: ASTM F3125, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers.

1. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C

F. Galvanizing Repair Paint: SSPC-Paint 20.

G. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

1.11 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2.

B. Do not prime paint joists and accessories

C. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.

D. Shop priming of joists and joist accessories is specified in Section 099123 "Interior Painting

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PART 2 - EXECUTION

2.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

2.2 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. No field modifications to the joists will be permitted unless approved by Architect/Engineer and the joist manufacturer.

C. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications joist manufacturer's written instructions, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.

D. Field weld joists to supporting steel bearing plates. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

E. Install and connect bridging concurrently with joist erection before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

2.3 REPAIRS

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

B. Touchup Painting:

1. Immediately after installation, clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists bearing plates**,** and accessories.

a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
b. Apply a compatible primer of same type as primer used on adjacent surfaces.

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2. Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting." Section 099600 "High-Performance Coatings."

2.4 FIELD QUALITY CONTROL

A. Special Inspections and field quality control testing: Owner will engage a qualified special inspector to perform field tests and inspections and prepare test reports.

1. Refer to drawings for testing and special inspection requirements.

2. Prepare and submit reports within 7 days of completing tests and inspections. Distribute reports to Architect, Engineer, Owner (or owner's representative), and Contractor. Clearly indicate non-compliance on reports.

B. Non-Compliant Work:

1. The contractor shall remove and replace all non-compliant work, or, at the contractor's expense, perform additional testing to verify compliance. Contractor shall submit results of additional testing to Architect, Engineer, and Owner (or owner's representative) for review and approval.

END OF SECTION

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SECTION 05 31 00 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof deck.
2. Acoustical roof deck.

B. Related Requirements:
1. Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.
2. Section 055000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Roof deck.
2. Acoustical roof deck.

B. Shop Drawings:

1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.3 INFORMATIONAL SUBMITTALS

A. Certificates:

1. Welding certificates.
2. Product Certificates: For each type of steel deck.

B. Test and Evaluation Reports:

1. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

a. Power-actuated mechanical fasteners.
b. Acoustical roof deck.

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2. Research Reports: For steel deck, from ICC-ES showing compliance with the building code.

C. Field Quality-Control Submittals:

1. Field quality-control reports.

D. Qualification Statements: For welding personnel and testing agency.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Special Inspector Qualifications: A qualified person employed or retained by an approved agency that has the recommended experience and certifications as summarized in Appendix C of the current International Code Council (ICC) Special Inspection Manual.

C. Welding Qualifications: Qualify procedures and personnel in accordance with SDI QA/QC and the following welding codes:
1. AWS D1.1/D1.1M.
2. AWS D1.3/D1.3M.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store products in accordance with SDI MOC3. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck in accordance with AISI S100.

B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.

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2.2 ROOF DECK

A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with SDI RD and with the following:

1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 50, G60 zinc coating.
2. Deck Profile: As indicated on drawings.
3. Profile Depth: As indicated on drawings.
4. Design Uncoated-Steel Thickness: As indicated on drawings.
5. Span Condition: Triple span or more.
6. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 ACOUSTICAL ROOF DECK

A. Acoustical Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with SDI RD and with the following:

1. Galvanized- and Shop-Primed Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 40, G60 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.

    a. Color: Manufacturer's standard White.
2. Deck Profile: As indicated on drawings.
3. Profile Depth: As indicated on drawings.
4. Design Uncoated-Steel Thickness: As indicated on drawings.
5. Span Condition: Triple span or more.
6. Side Laps: Overlapped or interlocking seam at Contractor's option.
7. Acoustic Perforations: Deck units with manufacturer's standard perforated vertical webs.
8. Sound-Absorbing Insulation: Manufacturer's standard premolded roll or strip of glass or mineral fiber.

9. Acoustical Performance: NRC 0.90, tested in accordance with ASTM C423.

2.4 ACCESSORIES

A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

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E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

G. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

H. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch-wide flanges and recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.

I. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.

J. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories in accordance with SDI C, SDI NC, and SDI RD, as applicable; manufacturer's written instructions; and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

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G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install in accordance with deck manufacturer's written instructions.

J. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.

3.3 INSTALLATION OF ROOF DECK

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, as indicated on drawings.

1. Weld Diameter: as indicated on drawings.
2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 12 inches apart in Zone 1 and 6 inches apart in Zones 2 and 3, based on roof-area definitions in FM Global Loss Prevention Data Sheet 1-28.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports as indicated on drawings

C. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
1. Fasten with a minimum of 1-1/2-inch-long welds.

D. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped 2 inches minimum or butted at Contractor's option.

E. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld or mechanically fasten flanges to top of deck. Space welds or mechanical fasteners not more than 12 inches apart with at least one weld or fastener at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.

F. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels in accordance with deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

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1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

G. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive in accordance with manufacturer's written instructions to ensure complete closure.

H. Sound-Absorbing Insulation: Installation into topside ribs of deck as specified

3.4 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint in accordance with ASTM A780/A780M and manufacturer's written instructions.

B. Repair Painting:

1. Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation and apply repair paint.
2. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
3. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
4. Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.5 FIELD QUALITY CONTROL

A. Special Inspections and field quality control testing: Owner will engage a qualified special inspector to perform field tests and inspections and prepare test reports.

1. Refer to drawings for testing and special inspection requirements.

2. Prepare and submit reports within 7 days of completing tests and inspections. Distribute reports to Architect, Engineer, Owner (or owner’s representative), and Contractor. Clearly indicate non-compliance on reports.

B. Non-Compliant Work:

1. The contractor shall remove and replace all non-compliant work, or, at the contractor’s expense, perform additional testing to verify compliance. Contractor shall submit results of additional testing to Architect, Engineer, and Owner (or owner’s representative) for review and approval.

END OF SECTION

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SECTION 05 40 00 - COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Formed steel stud exterior wall framing.

B. Exterior wall sheathing.

1.2 RELATED REQUIREMENTS

A. Structural Drawings.

B. Section 07 27 23 - Gypsum Sheathing Air Barriers: Wall sheathing.

C. Section 09 21 16 - Gypsum Board Assemblies: Cold-formed steel stud nonstructural interior wall framing.

1.3 DEFINITIONS

A. General: See AISI S240 for definitions of terms used in this section.

B. Connection: A combination of structural elements and joints used to transmit forces between two or more members.

C. Connector: A device used to transmit forces between cold-formed steel structural members or between a cold-formed steel structural member and another structural element.

1.4 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).

B. AISI S201 - North American Standard for Cold-Formed Steel Framing - Product Data; 2017.

C. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).

D. AISI S400 - North American Standard for Seismic Design of Cold-Formed Steel Structural Systems; 2015, with Supplement (2016).

E. AISI S200 - North American Standard for Cold-Formed Steel Framing - General Provisions; 2012.

F. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.

G. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

H. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

I. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

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J. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

K. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

L. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2025.

M. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

N. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2025.

O. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020 (Reapproved 2024).

P. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.

Q. ASTM C1513 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections; 2018.

R. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete Elements; 2022.

S. ASTM E1190 - Standard Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members; 2018.

T. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2020.

U. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).

V. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018, with Errata (2022).

W. OBC-2024 - 2024 Ohio Building Code; 2024.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with work of other sections that is to be installed in or adjacent to metal framing systems, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

B. Preinstallation Meeting: Conduct a preinstallation meeting at Project site prior to the start of the work of this section; require attendance by affected installers.

1.6 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.

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C. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.

1. Show layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work
3. Indicate framing layout.
4. Describe method for securing studs to tracks and for framing connections.

D. Design Data:

1. Shop drawings shall be signed and sealed by a qualified professional structural engineer currently licensed in Ohio.
2. Calculations for loadings and stresses of cold-formed metal framing, signed and sealed by a qualified professional structural engineer currently licensed in Ohio.
3. Details and calculations for framing connectors, signed and sealed by a qualified professional structural engineer currently licensed in Ohio.
4. Inspection Reports: Provide material verification Inspection Reports in accordance with requirements of AISI S240.
5. Inspection Reports: Provide Inspection Reports for welding in accordance with requirements of AISI S240.

E. Delegated Design Submittal: For cold-formed steel framing indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

F. Qualification Data: For professional engineer.

G. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before the start of scheduled welding work.

H. Product Test Reports: From a qualified testing agency, unless otherwise indicated, indicating that each of the following complies with requirement, based on evaluation of comprehensive tests for current products.

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Miscellaneous structural clips and accessories.

1.7 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

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B. Professional Engineer Qualifications: Design framing system under direct supervision of a Professional Structural Engineer experienced in design of this type of work and licensed in Ohio. Engineering services are defined as those performed for installations of cold-formed-metal framing work that are similar to those indicated for this Project in material, design, and extent.

C. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

D. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.3/D1.3M and dated no more than 12 months before start of scheduled welding work.

E. AISI Specifications and Standards: Comply with AISI S100 "North American Specification for the Design of Cold-Formed Steel Structural Members," AISI S200 "North American Standard for Cold-Formed Steel Framing - General Provisions," and AISI S220 "North American Standard for Cold-Formed Steel Framing - Nonstructural Members."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect and store cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design framing, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As required by Code.

2. Deflection Limits: Design framing systems to withstand design loads within deflections greater than the following:

a. Exterior Non-Load-Bearing Framing:

1) Horizontal deflection of 1/240 of the wall height for metal panel systems.

2) Horizontal deflection of 1/600 of the wall height for masonry systems.

3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.

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4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load, plus superimposed dead load, deflection of primary building structure.

C. Interior Non-Load-bearing Framing Design Criteria, General:

1. Minimum Design Loads: Per Contract Documents, to include:

a. Weight of Building Components: As required.

b. Internal Wall Pressure: 5 psf.

c. Elements less than or equal to 8 feet above adjacent floor surface:

1) Uniform load of 50 lb/ft applied in any direction.

2) Concentrated load of 200 lb applied in any direction.

3) Uniform and concentrated loads need not be assumed to act concurrently.

d. Elements greater than 8 feet above adjacent floor surface:

1) Uniform load of 10 lb/ft applied in any direction.

2) Concentrated load of 50 lb applied in any direction.

3) Uniform and concentrated loads need not be assumed to act concurrently.

2. Deflection Limits: Maximum of 1/240 of the member length, 1/4 inch maximum for permanent loads, 1/2 inch maximum for transient loads

3. Design systems to provide for movement of members without damage of overstressing, connection failure or other detrimental effects with subject to a maximum temperature change of 120 degrees F.

4. Design systems and associated connections to maintain clearances and allow for construction tolerances and to accommodate live load plus superimposed deflections of supporting elements, L/360 of the member length, 1/4 inch maximum movement.

2.2 MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

1. Grade: As required by structural performance.

2. Galvanized in accordance with ASTM A653/A653M, G90/Z275 coating.

B. Steel Sheet for Vertical Deflection Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.

2. Galvanized in accordance with ASTM A653/A653M, G90/Z275 coating.

2.3 NON-LOAD-BEARING WALL FRAMING

A. Design Requirements: Design cold-formed framing systems, components and connectors to withstand specified design loads in compliance with OBC-2024, ASCE 7, AISI S100, AISI S240, and AISI S400.

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B. Comply with requirements for Contractor's design-related professional design services indicated in Section 01 40 00 - Quality Requirements.

C. Design Criteria: As indicated on the drawings, as specified in Performance Requirements article, and as follows:

1. Wind Loads: Refer to Structural drawings.

2. Live load deflection meeting the following, unless otherwise indicated:

a. Exterior Walls: Maximum horizontal deflection under wind load of 1/240 of span.

b. Design nonaxial loadbearing framing to accommodate not less than 3/4 in vertical deflection.

3. Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.

4. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

5. Fabrication:

a. Shop-fabricate cold-formed framing systems and connectors to the greatest extent possible.

b. Deliver to project site in largest practical sections.

2.4 MATERIALS

A. Material and Product Requirements Criteria: AISI S201.

B. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.

1. Structural Grade: As required to meet design criteria.

2. Corrosion Protection Coating Designation: CP 60 in accordance with AISI S240.

2.5 STRUCTURAL FRAMING COMPONENTS

A. Wall Studs and Track Sections: AISI S240; c-shaped studs and u-shaped track sections in stud-matching nominal width and compatible height.

1. Minimum Base-Metal Gauge: As required to meet design criteria.

2. Depth: As indicated on the drawings.

B. CONNECTIONS

1. Performance Requirements: Provide connections in compliance with requirements of AISI S240.

2. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.

a. Structural Grade: As required to meet design criteria.

b. Corrosion Protection Coating Designation: CP 60 in accordance with AISI S240.

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3. Structural Performance: Maintain load and movement capacity required by applicable building code and specified design criteria.
4. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, shouldered screws or screws and anti-friction or stepped bushings, while maintaining structural performance of framing. Provide movement connections where indicated on drawings.

C. Vertical Deflection Clips, Exterior: Manufacturer's standard clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
1. Provide deflection clips to allow for movement +/- L/360 of beam span.

2.6 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated.

2.7 MISCELLANEOUS CONNECTIONS

A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

B. Anchor Bolts: ASTM F1554, threaded carbon-steel bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A153/A153M, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E488/E488M conducted by a qualified independent testing agency.
1. Acceptable Manufacturers:
a. Kwik-Bolt 3 by Hilti, Inc.
b. TruBolt Wedge anchor by ITW Red Head
c. Power-Stud by Powers Fasteners.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere

F. Welding Electrodes: Comply with AWS D1.1/D1.1M.

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2.8 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

B. Galvanizing Repair: Touch up bare steel with zinc-rich paint in compliance with ASTM A780/A780M.

C. Touch-Up Primer for Galvanized Surfaces: High-zinc-dust-content paint for re-galvanizing welds in steel, complying with SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.

1. Provide interior, field-applied primer with a VOC content not greater than 250 g/L.

D. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining, nongaseous grout, complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

1. Basis of Design: Sika; SikaGrout 212.

E. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic.

F. Sill Sealer Gasket: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify field measurements and adjust installation as required.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Structural Wall Foundations: For gaps between wall bottom track and top of foundation 1/4 inch or greater, level substrate with loadbearing shims or grout between track and foundation.

B. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION - GENERAL

A. Install structural members and connections in compliance with ASTM C1007.

3.4 INSTALLATION, GENERAL

A. Install wall studs plumb and level except where designed as sloping members, as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

1. Cut framing members by sawing or shearing; do not torch cut.

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2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

B. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

C. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

D. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

E. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.

F. Install load-bearing framing members full length in one piece unless splice connections are indicated for track or tension members. Splicing of studs is not permitted.

G. Install load-bearing studs; brace, and reinforce to develop full strength and achieve design requirements.

1. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed.

2. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

H. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

I. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

J. Install intermediate studs above and below openings to align with wall stud spacing.

K. Provide deflection allowance in stud track, directly below horizontal building framing at non-loadbearing framing.

L. Attach cross studs to studs for attachment of fixtures anchored to walls.

M. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

N. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

O. Touch-up field welds and damaged corrosion-protected surfaces zinc-rich paint in compliance with ASTM A780/A780M.

3.5 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Provide material verification inspections in accordance with requirements of AISI S240.

C. Engage a qualified independent testing and inspecting agency to provide testing and inspections for field and shop welding, mechanical fastening, and cold-formed steel light-frame construction in accordance with requirements of AISI S240.

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1. Prepare test reports; submit promptly to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 TOLERANCES

A. Studs - Vertical Alignment (Plumbness): 1/960 of span or 1/8 inch in 10 ft, in accordance with ASTM C1007.

B. Studs - Maximum Variation from True Position: 1/8 inch in accordance with ASTM C1007.

C. Stud Spacing: Not more than plus or minus 1/8 inch from the designated spacing, provided that the cumulative error does not exceed the minimum fastening requirements of sheathing or other finishing materials in accordance with ASTM C1007.

3.7 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to manufacturer's written instructions and ASTM A780/A780M.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

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SECTION 05 50 00 - METAL FABRICATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Shop fabricated utilitarian steel items, including:

1. Miscellaneous framing and supports.
2. Metal ladders.
3. Metal floor plate.
4. Miscellaneous steel trim.
5. Metal bollards.
6. Loose bearing and leveling plates.

B. Products furnished, but not installed, under this Section include the following:

1. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

B. Section 04 20 00 - Unit Masonry: Placement of metal fabrications in masonry.

C. Section 05 12 00 - Structural Steel Framing: Structural steel column anchor bolts.

D. Section 05 52 13 - Pipe and Tube Railings.

1.3 REFERENCE STANDARDS

A. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008 (Reaffirmed 2018).

B. 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.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2024.

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G. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

H. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.

I. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2021a.

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

K. 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; 2025.

L. 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.

M. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.

N. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete Elements; 2022.

O. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2020.

P. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

Q. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).

R. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Errata (2026).

S. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2014, with Errata (2020).

T. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019, with Editorial Revision (2025).

U. MFMA-4 - Metal Framing Standards Publication; 2004.

V. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: For the following:

1. Fasteners.
2. Shop primers.
3. Shrinkage-resisting grout.
4. Slotted channel framing.
5. Metal bollards.

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C. Shop Drawings: Show fabrication and installation details. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1. Provide Shop Drawings for the following:

a. Miscellaneous framing and supports for applications where framing and supports are not specified in other Sections.

b. Railings; posts and guardrails.

c. Metal ladders.

d. Metal floor plate and supports.

e. Loose steel lintels.

2. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

D. Delegated Design Submittals: For metal ladders and miscellaneous framing and supports submit shop drawings and supporting calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design data: Submit drawings and supporting calculations, signed and sealed by a qualified professional structural engineer.

a. Include the following, as applicable:

1) Design criteria.

2) Engineering analysis depicting stresses and deflections.

3) Member sizes and gauges.

4) Details of connections.

5) Support reactions.

6) Bracing requirements.

E. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

F. Delegated Designer's Qualification Statement.

G. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.5 QUALITY ASSURANCE

A. Delegated Design: Design metal ladders, railings, and miscellaneous steel framing and supports required for support of the Work, including weld plates and anchors indicated to be cast into concrete or built into unit masonry and applications where framing and supports are not specified in other Sections, under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Ohio.

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B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.2/D1.2M and dated no more than 12 months before start of scheduled welding work.

C. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

1.6 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Design Loads for Support of Work Specified in Other Sections: Comply with requirements of items being supported as indicated on Drawings and in other Sections.

B. Thermal Movements: Allow for movement from ambient and surface temperature changes.

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

2.2 MATERIALS - STEEL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Sections: ASTM A36/A36M.

C. Steel Tubing: ASTM A500/A500M Grade B cold-formed structural tubing.

D. Plates: ASTM A283/A283M.

E. Slotted Channel Fittings: ASTM A1011/A1011M.

F. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4. Sizes, profiles, and configurations of framing to comply with performance requirements and delegated design calculations.

1. Size of Channels: 1-5/8 by 1-5/8 inches, minimum.

2. Cold-Rolled Steel: ASTM A1008/A1008M, structural steel, Grade 33; thickness not less than 0.0528-inch minimum; hot-dip galvanized after fabrication.

2.3 FASTENERS

A. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.

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B. Provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls.

1. Provide stainless steel fasteners for fastening aluminum, stainless steel, or nickel silver.

2. Provide bronze fasteners for fastening bronze.

C. Bolts, Nuts, and Washers: Regular hexagon-head bolts, ASTM A307, Grade A, galvanized to ASTM A153/A153M where connecting galvanized components; with hex nuts, ASTM A563; and, where indicated, flat washers.

D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

2.4 MISCELLANEOUS MATERIALS

A. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

B. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

C. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

D. Concrete: Comply with requirements in Section 03 30 00 for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 FABRICATION

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form exposed work with accurate angles and surfaces and straight edges. Fabricate items with joints tightly fitted and secured.

D. Continuously seal joined members by continuous welds. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

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2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

E. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

F. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

G. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

H. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

I. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 FABRICATED ITEMS

A. Posts and Guard Rails: As detailed; galvanized finish.

B. Lintels: As detailed; galvanized finish.

C. Ladders and Platforms : As detailed; steel, galvanized finish.

D. Slotted Channel Framing: Fabricate channels and fittings from structural steel complying with the referenced standards; factory-applied, rust-inhibiting thermoset acrylic enamel finish.

2.7 FABRICATED LADDERS

A. General:

1. Comply with ANSI A14.3, except for elevator pit ladders.
2. For elevator pit ladders, comply with ASME A17.1.

B. Steel Ladders:

1. Side Rails: 3/8 by 2 inches members; spaced at 18 inches apart.
2. Rungs: 2 inch depth by 3/4 inch depth solid square bar spaced 12 inches on center.
3. Space rungs 7 inches, minimum, from wall surface, except for elevator pit ladders.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.

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6. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets
7. Galvanize ladders, including mounting brackets and attachments.

2.8 MISCELLANEOUS FRAMING AND SUPPORTS

A. Provide steel framing and supports designed by a professional structural engineer for applications where miscellaneous steel required for support of the Work is not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Fabricate supports for operable partitions from continuous steel beams of sizes required to comply with performance requirements with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

2.9 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

2.10 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 80 steel pipe.

B. Fabricate bollards with 3/8-inch- thick, steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inch anchor bolts.

1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.

2.11 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize bearing and leveling plates.

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2.12 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.13 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.14 FINISHES - STEEL

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.

C. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

D. Slotted Channel Framing: ASTM A653/A653M, Grade 33.

2.15 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

A. Furnish setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.3 INSTALLATION - GENERAL

A. Install fabricated steel items to comply with requirements of items being supported, including manufacturers' written instructions, and requirements indicated on Shop Drawings.

B. Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

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C. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

D. Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Install items plumb and level, accurately fitted, free from distortion or defects.

F. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

G. Field weld components as indicated on shop drawings.

H. Perform field welding in accordance with AWS D1.1/D1.1M.

I. Obtain approval prior to site cutting or making adjustments not scheduled.

J. After erection, prime welds, abrasions, and surfaces not galvanized, except surfaces to be in contact with concrete.

3.4 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports securely to, and rigidly brace from, building structure.

3.5 INSTALLATION OF METAL LADDERS

A. Secure ladders to adjacent construction with the clip angles attached to the stringer.

B. Install brackets as required for securing of ladders welded or bolted to structural steel or built into masonry or concrete.

3.6 INSTALLATION OF METAL FLOOR PLATE

A. Install metal floor plates flush with finished surface. Adjust as required to avoid lippage that could present a tripping hazard.

3.7 INSTALLATION OF METAL BOLLARDS

A. Anchor bollards to existing construction. Provide four 3/4-inch bolts at each bollard unless otherwise indicated.

1. Embed anchor bolts at least 4 inches in concrete.

B. Fill bollards solidly with concrete, mounding top surface to shed water.

3.8 INSTALLATION OF LOOSE BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

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B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.9 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

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SECTION 05 52 13 - PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Utilitarian guardrails.

1.2 REFERENCE STANDARDS

A. AISC 207 - Standard for Certification Programs; 2025.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.

D. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

E. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire; 2019.

F. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube; 2022.

G. ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube; 2020.

H. ASTM B483/B483M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Tube and Drawn Pipe for General Purpose Applications; 2021.

I. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2021.

J. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

K. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Errata (2026).

L. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019, with Editorial Revision (2025).

1.3 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

2. Include the design engineer's seal and signature on each sheet of shop drawings.

C. Designer's Qualification Statement.

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1.4 QUALITY ASSURANCE

A. Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in Ohio, or personnel under direct supervision of such an engineer.

B. Welder Qualifications: Welding processes and welding operators qualified within previous 12 months.

C. Fabricator Qualifications:

1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 207.

2. A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.

3. A company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

PART 2 PRODUCTS

2.1 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.

B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 50 pounds per linear foot applied to the top of the assembly and in any direction, without damage or permanent set.

C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set.

D. Allow for expansion and contraction of members and building movement without damage to connections or members.

E. Dimensions: See drawings for configurations and heights.

1. Top Rails and Wall Rails: 1-1/2 inches diameter, round.

2. Intermediate Rails: 1-1/2 inches diameter, round.

3. Posts: 1-1/2 inches diameter, round.

F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

G. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

H. Welded Joints: Make visible joints butt tight, flush, and hairline; use methods that avoid discoloration and damage of finish; grind smooth, polish, and restore to required finish.

1. Ease exposed edges to a small uniform radius.

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2. Welded Joints:

a. Carbon Steel: Perform welding in accordance with AWS D1.1/D1.1M.

2.2 ALUMINUM MATERIALS

A. Aluminum Pipe: Schedule 40; ASTM B429/B429M, ASTM B241/B241M, or ASTM B483/B483M.

B. Aluminum Tube: Minimum wall thickness of 0.127 inch; ASTM B429/B429M, ASTM B241/B241M, or ASTM B483/B483M.

C. Solid Bars and Flats: ASTM B211/B211M.

D. Welding Fittings: No exposed fasteners; cast aluminum.

E. Straight Splice Connectors: Concealed spigot; cast aluminum.

F. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.

2.3 STEEL MATERIALS

A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.

B. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

C. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.

D. Galvanizing: In accordance with requirements of ASTM A123/A123M.

2.4 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured.

D. Welded Joints:

1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.

2. Continuously seal joined pieces by intermittent welds and plastic filler.

3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Weld connections that cannot be shop welded due to size limitations.

1. Weld in accordance with AWS D1.1/D1.1M.

2. Match shop welding and bolting.

3. Clean welds, bolted connections, and abraded areas.

4. Repair galvanizing with galvanizing repair paint per ASTM A780/A780M.

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PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

A. Apply one coat of bituminous paint to concealed aluminum surfaces that will be in contact with cementitious or dissimilar materials.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Anchor railings securely to structure.

D. Field weld anchors as indicated on shop drawings. Touch-up welds with primer. Grind welds smooth.

E. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.4 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

3.5 SCHEDULE

A. Penthouse Roof Parapet: Aluminum tube; mill finish.

B. Mechanical Room M101 Guardrail: Steel tube; galvanized finish.

END OF SECTION

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SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Plywood sheathing.

B. Preservative treated wood materials.

C. Fire retardant treated wood materials.

D. Concealed wood blocking, nailers, and supports.

E. Miscellaneous wood nailers, furring, and grounds.

1.2 RELATED REQUIREMENTS

A. Section 07 27 23 - Gypsum Sheathing Air Barriers: Gypsum-based sheathing.

B. Section 07 72 00 - Roof Accessories: Prefabricated roof curbs.

1.3 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

B. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel; 2021.

C. ASTM D2898 - Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010 (Reapproved 2024).

D. AWPA M4 - Standard for the Handling, Storage, Field Fabrication and Field Treatment of Preservative-Treated Wood Products; 2023.

E. AWPA U1 - Use Category System: User Specification for Treated Wood; 2025.

F. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. ITS (DIR) - Directory of Listed Products; Current Edition.

H. PS 1 - Structural Plywood; 2023.

I. PS 20 - American Softwood Lumber Standard; 2025.

J. UL (DIR) - Online Certifications Directory; Current Edition.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Submit technical data on wood treatment.

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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.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.

1. Species: Douglas Fir-Larch, unless otherwise indicated.

2. 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.

3. 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.

4. Lumber of other species or grades is acceptable provided structural characteristics are equivalent to or better than products specified.

2.2 DIMENSION LUMBER

A. 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. Roof Sheathing, For Standing Seam Roof, R01, R02:

1. Plywood Panels:

a. Comply with PS 1.

b. Bond Classification: Exposure 1.

c. Grade: Structural 1 C-D.

B. Other Applications:

1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.

2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.

3. Other Locations: PS 1, C-D Plugged or better.

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2.4 FIRE-RETARDANT TREATMENT (FRT)

A. Factory-treat wood members in accordance with AWPA U1 and use category indicated.

B. Fire-Retardant Treatment: Exterior Type B, Use Category UCFB.

1. Treat wood in locations indicated on drawings.

C. Kiln-dry after treatment (KDAT) to maximum moisture content of 19 percent for sawn material and 15 percent for plywood.

D. Fabrication of FRT Wood:

1. Ripping or milling of boards, lumber, and timber after treatment is not permitted.

2. Field cutting to length and drilling of holes in boards, lumber, and timber are permitted without additional treatment.

3. Field cutting and drilling of holes in plywood are permitted.

E. Label or brand FRT wood with classification mark of UL (DIR) or ITS (DIR) or other approved inspection agency, the treatment plant, name of treatment, species of wood, flame spread and smoke developed index, method of drying after treatment, and treating standard.

1. In addition, label Exterior Type B wood with the words: NO INCREASE IN THE LISTED CLASSIFICATIONS WHEN SUBJECTED TO THE STANDARD RAIN TEST. In accordance with ASTM D2898.

2.5 PRESSURE-PRESERVATIVE TREATMENT (PPT)

A. Factory-treat wood members in accordance with AWPA U1 and use category indicated.

B. Applications - Treat the Following:

1. Wood framing in contact with exterior foundation walls where member is less than 8 inches from exposed earth: Use Category UC2, above ground, interior, damp.

2. Sleepers and sills on concrete or masonry in direct contact with earth: Use Category UC2, above ground, interior, damp.

3. Wood framing members in direct contact with interior of exterior masonry or concrete walls below grade: Use Category UC2, above ground, interior, damp.

4. Lumber and plywood in contact with membrane roofing and flashing: Use Category UC3B, above ground, exterior.

5. Lumber and plywood in contact with waterproofing and flashing: Use Category UC4A, ground contact.

C. Kiln-dry wood after treatment with waterborne preservative to maximum moisture content of 19 percent for lumber and 15 percent for plywood.

D. Fabricate to maximum extent possible before treatment.

E. Label preservative-treated wood with marking as required by AWPA U1 and ICC (IBC). Unless otherwise permitted by standard U1 and building code, include the following markings: AWPA U1, accredited inspection agency mark, treating plant identification, type of preservative, preservative retention, and permitted end use.

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F. Field Treatment for Cuts and Holes in Preservative-Treated Wood: Comply with AWPA M4.

2.6 ACCESSORIES

A. Metal and Finish of Fasteners:

1. Fire-Retardant-Treated Wood:

a. Nails, timber rivets, wood screws, and lag screws: Hot-dip galvanized steel complying with ASTM A153/A153M Class D.

b. Staples: Type 304 stainless steel.

c. Fasteners other than staples, nails, timber rivets, wood screws, and lag screws: Mechanically deposited zinc-coated steel, ASTM B695 Class 55 or better.

2. Preservative-Treated Wood:

a. Nails, timber rivets, wood screws, and lag screws - general use: Hot-dip galvanized steel complying with ASTM A153/A153M Class D.

b. Staples: Type 304 stainless steel.

c. Fasteners other than staples, nails, timber rivets, wood screws, and lag screws: Mechanically deposited zinc-coated steel, ASTM B695 Class 55 or better.

3. Untreated Wood: Unfinished steel.

PART 3 EXECUTION

3.1 PREPARATION

A. 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.

3.3 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 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.

C. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

D. Provide nonstructural framing and blocking to support the following:

1. Cabinets and shelf supports.

2. Wall brackets.

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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.

3.4 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

3.5 INSTALLATION OF CONSTRUCTION PANELS

A. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
   1. Screw or nail panels to framing; staples are not permitted.

3.6 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.
B. Variation from Plane, Other than Floors: 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

END OF SECTION

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SECTION 06 41 00 - ARCHITECTURAL WOODWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wood millwork and casework with laminate cladding.

B. Cabinet and drawer hardware.

1.2 RELATED REQUIREMENTS

A. Section 06 10 53 - Miscellaneous Rough Carpentry.

B. Section 09 22 16 - Non-Structural Metal Framing.

C. Section 10 56 17 - Wall Mounted Standards and Shelving.

D. Section 12 36 00 - Countertops.

1.3 ABBREVIATIONS AND ACRONYMS

A. AWI: Architectural Woodwork Institute.

B. HPDL: High-pressure decorative laminate.

C. PTB: Particleboard.

1.4 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. ANSI/AWI 0400 - Factory Finishing; 2022.

D. ANSI/AWI 0620 - Finish Carpentry/Installation; 2024.

E. ANSI/AWI 0641 - Architectural Wood Casework; 2019.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

G. AWI 200 - Care and Storage; 2018.

H. AWI 300 - Materials; 2018.

I. BHMA A156.9 - Cabinet Hardware; 2020.

J. CTB-117 - Requirements, Test Procedure and Apparatus for Testing the Smolder Resistance of Materials Used in Upholstered Furniture; 2013.

K. ISO 4586-3 - High-Pressure Decorative Laminates (HPL, HPDL) – Sheets Based on Thermosetting Resins (Usually Called Laminates) – Part 3: Classification and Specifications for Laminates Less than 2 mm Thick and Intended for Bonding to Supporting Substrates; 2018.

L. NFPA 265 - Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile or Expanded Vinyl Wall Coverings on Full Height Panels and Walls; 2023, with Errata.

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M. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate schedule of climate-controlled rooms with schedule of storage of wood and wood-based materials requiring climate-controlled environments.

2. Coordinate work of this section with installation of wood blocking, wood backing, metal strapping, and other anchorage that provides casework backing and structural support.

3. Coordinate work of this section with rough-in plumbing and rough-in electrical integrally-related with woodwork.

B. Preinstallation Meeting: Convene preinstallation meeting not less than one month prior to completion of framing behind woodwork; require attendance of contractor, framing contractor, and casework fabricator.

1. Review locations of woodwork backing and structural support.

2. Review backing attachment method to wall framing as indicated on drawings.

1.6 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Samples:

1. Samples, Laminate-Clad Panels: For each laminate-clad type, submit two, laminate-clad sample panels; size: 8 by 8 inches; thickness: 3/4 inch.

2. Samples, Hardware: For each hinge, pull, shelf rest, and cabinet lock type, submit one sample, full-size, indicating specified finish.

3. Samples, Hardware: For each drawer slide type, submit one sample, indicating specified finish; size: 6 inches.

C. AWI Test Reports: Provide report confirming woodwork conforms to Architectural Woodwork Institute specified performance requirements. Provide test reports confirming:

1. Casework awarded duty level.

2. Casework conforms to aesthetic requirements and installation requirements.

D. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

1.7 QUALITY ASSURANCE

A. Fabricator/Installer Qualifications: Firm specializing in fabricating and installing products specified in this section with minimum five years of documented experience; with qualifications indicating ability to comply with requirements of this section.

1. Single Source Responsibility: Provide fabrication and installation from single woodworking company.

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1.8 FIELD CONDITIONS

A. Ambient Conditions for Acclimation, Installation, and Post-Installation of Wood-Based Products:

1. Acclimation Period Prior to Installation: 72 hours minimum, inside installation environment.

2. Temperature Conditions During Installation and Post-Installation: Maintain temperature between 60 degrees F and 90 degrees F.

3. Relative Humidity Conditions During Acclimation, Installation, and Post-Installation: Maintain relative humidity between 25 and 45 percent.

4. Maximum Sustained Time outside Specified Relative Humidity Range: 24 hours.

PART 2 PRODUCTS

2.1 ARCHITECTURAL WOODWORK

A. Casework Finish: Wood millwork and casework with laminate cladding.

B. Provide woodwork and woodwork components in sizes and profiles as indicated on drawings.

1. Interior Clearances: Comply with specified performance requirements.

C. Scribed Fillers:

1. Finish and Materials: Same materials and finish as exposed surfaces.

2. Material thickness: Comply with specified performance requirements.

2.2 PERFORMANCE REQUIREMENTS

A. Architectural Woodwork Institute (AWI) Performance Requirements:

1. Comply with AWI 300, ANSI/AWI 0641, ANSI/AWI 0400, and ANSI/AWI 0620 as applicable for specified woodwork finish, aesthetic grade, and performance duty level.

a. Product Performance Duty Level: Duty Level 3.

2. Panel and Material Thicknesses: Provide panels and materials as required to meet specified performance duty level, subject to minimum thickness requirements of AWI 300 and ANSI/AWI 0641 and flatness requirements indicated below.

3. Panel Flatness: Provide panels with maximum variation from flat in 12 inches as measured diagonally across panel.

a. Premium Grade: Plus or minus 0.063 inch maximum.

b. Custom Grade: Plus or minus 0.047 inch maximum.

4. Cabinet Door Flatness:

a. Comply with specified performance requirements.

2.3 WOOD MILLWORK AND CASEWORK WITH LAMINATE CLADDING

A. Casework Construction:

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1. Frameless Cabinet and Door Interface: Flush overlay.
2. Door and Drawer Front Profile: Flush.
3. Reveal Dimensions: Comply with performance requirements.

B. Wood Drawer Boxes with Laminate Cladding:
1. Comply with specified performance requirements.

C. Custom Grade - Laminate-Clad Wood Casework:
1. Exposed Exterior Surfaces, Panels to Receive Laminate Cladding:
a. HPDL Panels; Surface Finish: As specified.
2. Exposed Interior Surfaces at Door and Drawer Fronts:
a. Same laminate materials and thicknesses as exposed exterior surfaces.
1) Color to match exposed interior or face.
3. Exposed Interior Surfaces Except Door and Drawer Front Surfaces:
a. Comply with specified performance requirements.
4. Semi-Exposed Surfaces; Panels to Receive Laminate Cladding:
a. Comply with specified performance requirements.

D. Edgebanding Applications for Laminate-Clad Wood Casework:
1. Drawer Box Top Edges:
a. Visible Cores: Provide edgebanding to match drawer side.

E. Edgebanding Materials for Laminate-Clad Wood Casework:
1. Comply with specified performance requirements.

2.4 EDGE TREATMENT APPLICATIONS

A. Front Edges of Frameless Cabinets:
1. Comply with specified performance requirements.

B. Top Edges of Cabinets:
1. Comply with specified performance requirements.

C. Hinged Door Edges:
1. Comply with specified performance requirements.

D. Drawer Front and Drawer False Front Edges:
1. Comply with specified performance requirements.

E. Adjustable Shelf Edges, Semi-Exposed Surfaces:
1. Comply with specified performance requirements.

F. Edges of Cut-Outs:
1. Comply with specified performance requirements.

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2.5 HPDL-CLAD PANELS

A. Description: Panels consisting of High-Pressure Decorative Laminate (HPDL) faces applied to cores; panel layup with face ply, back ply, and core of either single ply or odd number of inner plies, to produce balanced construction panel.

1. Panels subject to size limitations, minimum thickness requirements, and fabrication tolerances of specified aesthetic grade and performance duty level in accordance with AWI 300 and ANSI/AWI 0641.

B. HPDL Laminates Less than 0.08 inch Thick: Comply with ISO 4586-3.

1. Exposed Backer Materials:

a. Same materials, thickness and color as laminate face.

2. Concealed Backer Materials:

a. Laminate materials as required for balanced construction panel and recommended by laminate manufacturer for application.

3. Products:

a. Refer to Interior Finish Schedule on drawings.

1) Exposed Exterior Surfaces, Color: As scheduled.

2) Exposed Interior Surfaces, Color: White.

3) Semi-Exposed Surfaces, Color: Matching exposed exterior surfaces.

C. Panel Cores:

1. Particleboard (PTB).

2. Medium Density Fiberboard Core (MDF).

2.6 PANEL CORES

A. Particleboard (PTB):

1. Description: Composite panel composed of cellulosic particles, additives, and bonding system; comply with ANSI A208.1.

2. Grade:

a. M-2.

3. Thickness: 3/4 inch.

4. Moisture-Resistant Category: MR50.

B. Medium Density Fiberboard (MDF):

1. Description: Composite panel composed of cellulosic fibers, additives, and bonding system cured under heat and pressure; comply with ANSI A208.2.

2. Grade: 155.

3. Panel Thickness: 3/4 inch.

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2.7 CONCEALED CABINET BASE COMPONENTS

A. Cabinet Base Toe-Kick Subfronts:

1. Materials and Size: Fabricator's choice subject to requirements of ANSI/AWI 0641.
2. Finished Face of Toe Kick Subfronts: As indicated on drawings.

B. Cabinet Base Blocking and Stretchers:

1. Materials and Size: Fabricator's choice subject to requirements of ANSI/AWI 0641.

C. Cabinet Base Sleepers:

1. Materials and Size: Fabricator's choice subject to requirements of ANSI/AWI 0641.

2.8 WOOD AND WOOD-BASED MATERIALS

A. AWI 200 Wood Moisture Content Requirements:

1. Climate Zone 2: Between 6 and 10 percent.

B. AWI 300 General Requirements for Wood.

1. Provide wood in accordance with AWI 300.

C. Wood Anchoring Strips:

1. Materials and Size: Fabricator's choice subject to requirements of ANSI/AWI 0641.

2.9 CABINET AND DRAWER HARDWARE

A. Hinges, Number of Hinges for Each Cabinet Door:

1. Comply with specified performance requirements.

B. Hinges, Self-Closing, Integrated Damper Hinges:

1. Description: Self-closing hinges with integrated damper mechanisms.
2. Comply with specified performance requirements.
3. Features: Provide soft-closing integrated damper hinges.
4. Opening Range: Between 115 to 150 to degrees.
5. Material and Finish: Steel with polished finish.

C. Cabinet Door and Drawer Pulls: Provide one at each door and drawer.

1. Description: Back-mounted pulls.
2. Comply with specified performance requirements.
3. Design: U-shape wire pulls.
4. Center-to-Center Mounting Dimension: 4 inches.
5. Material and Finish: Satin stainless steel.

D. Shelf Rests:

1. Description: Metal shelf rests for installation into prepared holes in substrate.
2. Comply with specified performance requirements.

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E. Drawer Slides: Provide at each drawer.

1. Description: Hardware units that suspend drawers and provide controlled drawer sliding.
2. Comply with specified performance requirements.
3. Comply with BHMA A156.9, Heavy Duty Grade 1HD-100.
4. Features: Self-closing.
5. Mounting: Undermount concealed.
6. Travel: Full extension.

F. Cabinet Door Keyed Locks with Dead Bolts with Strike Plates : Where "lockable" is indicated on the drawings.

1. Description: Keyed cylinder locks for securing cabinet doors.
2. Keying Action: Key projects and retracts dead bolts.
3. Mounting: Half-mortised into back of door.
4. Products:
   a. (Basis of Design) ASSA ABLOY Access and Egress Hardware group, Inc; Yale Cabinet Locks No. 511S: www.yalecommercial.com/en.
   b. C.R. Laurence Co., Inc.
   c. Knape & Vogt Mfg. Co.

2.10 CASEWORK ACCESSORY COMPONENTS

A. Grommets: Plastic, with matching slotted caps; round.

1. Applications: Where indicated on drawings.
2. Shape: Round.
3. Inside Diameter: 1-1/2 inches.
4. Color: As indicated on drawings.
5. Products:
   a. Dave Mockett & Company, Inc: www.mockett.com.

2.11 ACCESSORIES

A. Wire Management Tray:

1. Size: 3-1/4 inch high, by 1 inch wide, by length of countertop or workstation.
2. Color: As selected by Architect.
3. Manufacturers:
   a. (Basis of Design) Doug Mockett & Company, Inc; WM2A, J-Shape Wire Manager: www.mockett.com.

B. Fasteners: Size and type to suit application.

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C. Concealed Joint Fasteners: Threaded steel.

D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

E. Adhesives: Type recommended by fabricator to suit application.

2.12 COUNTERTOP BRACKETS

A. Exposed Workstation Brackets: Fixed, L- or chevron-shaped, corner reinforced, face-of-partition mounting; with notched corner for cables and wall cleats.

1. Support Size: Length of horizontal leg such that it extends within 3 to 6 inches from workstation leading edge.

2. Materials: Formed steel shapes.

a. Finish: Manufacturer's standard, factory-applied, powder coat.

b. Color: As selected by Architect from manufacturer's full range.

3. Product:

a. A&M Hardware, Inc; Standard Brackets: www.aandmhardware.com.

b. Häfele America Co; SpeedBrace Work Surface Bracket: www.hafele.com/us/en.

B. Concealed Countertop Support Brackets: Heavy-duty cantilever supports fully hidden from view, for inside of wall, side-of-stud mounting; with 3/8 - 16 x 3" carriage bolts, and concealed behind gypsum board wall finish. Infill metal studs with continuous wood blocking attached to floor track and studs to 48 inches AFF.

1. Aluminum Shapes: Welded, extruded aluminum; T-shaped support member leg, and L-shaped vertical leg.

a. Finish: Black powder coat.

b. Vertical Leg: 18 inches.

c. Support Member Length:

1) Counters up to 25” Deep: 18 inches.

2) Counters up to 30” Deep: 24 inches.

d. T-Profile Support Member Depth:

1) Counters up to 25” Deep: 2 inches.

2) Counters up to 30” Deep: 3 inches.

2. Products:

a. Rakks/Rangine Corporation; Concealed EH Series Brackets: www.rakks.come.

b. Substitutions: Not permitted.

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2.13 FABRIC WRAPPED UPHOLSTERY

A. Fabric Wrapped Upholstery: Apply fabric monolithically in continuous run over cushion core, without joints or reveals, except where joints are indicated. Surface mount to woodwork with hook-and-loop tape.

B. Cushion Core: High resilient foam.

1. Thickness: As indicated on drawings.
2. Density: 2.7, nominal, rating.
3. Indentation Load Deflection (ILD): 30-36 ILD.
4. Flammability: Foam complies with requirements of CTB-117, and has a flame spread index of 25 or less, and a smoke developed index of 450 or less when tested in accordance with ASTM E84 or UL 723.

C. Fabric: Inherently fire-resistant fabrics manufactured for use as upholstery, with the following characteristics:

1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 450 or less.
2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265.
3. Backing: Acrylic where required.
4. Provide fabric from same dye lot, color and pattern.
5. Products: As indicated on drawings; see Finish Selections/A910.

D. Hook-and-Loop Tape: Manufacturer's standard two-part tape consisting of hooked part on fabric-wrapped cushion back and looped side on mounting surface.

2.14 FABRICATION

A. Shop-fabricate woodwork to dimensions, profiles, and details indicated on drawings.

B. Fabricate to maximum extents plausible, including doors, drawers, and hardware; fabricate units in sizes transportable through building openings.

C. When necessary to cut and fit on site, provide materials with sufficient allowance for cutting.

D. Wood Casework with Laminate Cladding: Apply laminates in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline.

E. Provide cutouts for plumbing fixtures, electrical lines, outlet boxes, inserts, communication lines, similar items, and hardware; verify locations of cutouts from on-site dimensions. Sand and seal cut edges.

F. Hardware: Install hardware in accordance with hardware manufacturer's written instructions; use fasteners supplied by hardware manufacturer.

G. Fabrication Tolerances: Comply with specified performance requirements.

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PART 3 EXECUTION

3.1 EXAMINATION

A. Verify woodwork and materials required for installation have been delivered, handled and stored as specified.

B. Verify cold-formed backing and structural support components that provide backing and structural support for woodwork are installed as indicated on drawings.

C. Verify wood blocking, wood backing, and wood furring that provides woodwork backing and structural support is installed as indicated on drawings.

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

E. Verify location and sizes of cutouts for appliances, special equipment, and sinks to be mounted in or adjacent to woodwork.

3.2 PREPARATION

A. Acclimate woodwork to environments indicated for installation.

3.3 INSTALLATION

A. Install and secure work of this section in accordance with specified performance requirements.

B. Install cabinet hardware in accordance with hardware manufacturer's documented instructions using hardware manufacturer's furnished fasteners.

C. Install scribe fillers to close gaps between woodwork and adjacent walls.

3.4 TOLERANCES

A. Comply with specified performance requirements for tolerances.

3.5 ADJUSTING

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

3.6 CLEANING

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

B. Clean exposed surfaces of millwork, casework, shelving, and hardware.

3.7 PROTECTION

A. Protect installed woodwork from subsequent construction operations.

END OF SECTION

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SECTION 06 83 16 - FIBERGLASS REINFORCED PANELING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. (WP-2) Fiberglass reinforced plastic panels.

B. Trim.

1.2 RELATED REQUIREMENTS

A. Section 10 26 00 - Wall and Door Protection: Decorative sheet wall protection.

1.3 REFERENCE STANDARDS

A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2024.

B. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

C. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels; 2022.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

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. Samples: Submit two samples 6 by 6 inch in size illustrating material and surface design of panels.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Fiberglass Reinforced Plastic Panels:

1. Marlite, Inc: www.marlite.com.

2. Nudo Products, Inc: www.nudo.com.

3. Panolam Industries International, Inc: www.panolam.com.

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4. VALTO, Inc (fka Crane Composites): www.ValtoEM.com.

2.2 PANEL SYSTEMS

A. (WP-2) Wall Panels:

1. Basis-of-Design:

a. Product indicated in Interior Finish Selections schedule on drawings/A910.

2. Panel Thickness: 0.075 inch.

3. Attachment Method: Adhesive only, with trim and sealant in joints.

2.3 MATERIALS

A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.

1. Surface Burning Characteristics: Class C; maximum flame spread index of 200 and smoke developed index of 450; when system tested in accordance with ASTM E84.

2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

3. Impact Strength: Greater than ___ ft lb force per inch, when tested in accordance with ASTM D256.

B. Trim: Vinyl; color coordinating with panel.

C. Adhesive: Type recommended by panel manufacturer.

D. Sealant: Type recommended by panel manufacturer; color matching panel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions and substrate flatness before starting work.

B. Verify that substrate conditions are ready to receive the work of this section.

3.2 INSTALLATION - WALLS

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

B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.

C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.

D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.

E. Install panels with manufacturer's recommended gap for panel field and corner joints.

F. Place trim on panel before fastening edges, as required.

G. Fill channels in trim with sealant before attaching to panel.

H. Install trim with adhesive and screws or nails, as required.

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I. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.

J. Remove excess sealant after paneling is installed and prior to curing.

END OF SECTION

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SECTION 07 01 50.19 - PREPARATION FOR RE-ROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Removal of existing flashing and counterflashings.

B. Temporary roofing protection.

1.2 RELATED REQUIREMENTS

A. Section 07 51 00 - Built-Up Bituminous Roofing.

B. Section 07 54 00 - Thermoplastic Membrane Roofing: Low slope roof system.

C. Section 07 61 13 - Standing Seam Sheet Metal Roofing and Wall Cladding: Steep slope roof system.

D. Section 07 62 00 - Sheet Metal Flashing and Trim: Replacement of flashing and counterflashings.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with affected mechanical and electrical work associated with roof penetrations.

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

1. Attendees:

a. Architect.

b. Contractor.

c. Owner.

d. Installer.

e. Roofing system manufacturer's field representative.

f. Inspection and Testing Agency Representatives.

2. Meeting Agenda: Provide agenda to participants prior to meeting in preparation for discussions on the following:

a. Removal and installation schedule.

b. Necessary preparatory work.

c. Protection before, during, and after roofing system installation.

d. Removal of existing roofing system.

e. Installation of new roofing system.

f. Temporary roofing and daily terminations.

g. Transitions and connection to and with other work.

h. Inspections and testing of installed systems.

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C. Schedule work to coincide with commencement of installation of new roofing system.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Submit for each type of material.

C. Shop Drawings: Indicate size, configuration, and installation details.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

1.6 FIELD CONDITIONS

A. Existing Roofing Systems:

1. Standing seam metal roofing over metal deck.

2. Built-up asphalt roofing over concrete deck.

B. Do not remove existing roofing when weather conditions threaten the integrity of building contents or intended continued occupancy.

C. Maintain continuous temporary protection prior to and during installation of new roofing system.

PART 2 PRODUCTS

2.1 COMPONENTS

A. See the following sections for additional information on components relating to this work:

1. Replacement and removal of existing roofing system in preparation for entire new roofing system, see Sections 07 51 00 and 07 61 13.

2. Remove existing flashing and counterflashings in preparation for replacement of these materials as part of this work, see Section 07 62 00 for material requirements.

2.2 MATERIALS

A. Patching Materials: Provide necessary materials in accordance with requirements of existing roofing system.

B. Temporary Roofing Protection Materials:

1. Contractor's responsibility to select appropriate materials for temporary protection of roofing areas as determined necessary for this work.

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PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that existing roof surface has been cleared of materials being removed from existing roofing system and ready for next phase of work as required.

3.2 PREPARATION

A. Sweep roof surface clean of loose matter.

B. Remove loose refuse and dispose of properly off-site.

3.3 MATERIAL REMOVAL

A. Remove metal counter flashings.

B. Remove roofing membrane, perimeter base flashings, flashings around roof protrusions, pitch pans and pockets.

C. Remove insulation and fasteners, cant strips, and blocking.

D. Remove vapor retarder, sheathing paper, underlay, and bitumen.

E. Repair existing deck surface to provide smooth working surface for new roof system.

3.4 INSTALLATION

A. Coordinate scope of this work with requirements for installation of new roofing system, see Section 07 54 00 and 07 61 13 for additional requirements.

3.5 PROTECTION

A. Provide protection of existing roofing system that is not having work performed on it.

B. Provide temporary protective sheeting over uncovered deck surfaces.

C. Turn sheeting up and over parapets and curbing. Retain sheeting in position with temporary fasteners.

D. Provide for surface drainage from sheeting to existing drainage facilities.

E. Do not permit traffic over unprotected or repaired deck surface.

END OF SECTION

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SECTION 07 11 13 - BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Bituminous dampproofing.

1.2 RELATED REQUIREMENTS

A. Section 07 21 00 - Thermal Insulation: Rigid insulation board used as protection board.

1.3 REFERENCE STANDARDS

A. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal; 1997 (Reapproved 2024).

B. ASTM D1227/D1227M - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing; 2013 (Reapproved 2024).

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meetings: Review dampproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1. Require attendance of dampproofing manufacturer and installers of related and adjoining materials including:
    a. Cast-in-place concrete.
    b. Unit masonry.
    c. Air-barriers.
    d. Subdrainage.
    e. Insulation.
2. Review schedules and coordination with other Work.
3. Review compatibility of materials and substrates.
4. Coordinate interface of dampproofing with air barrier.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide properties of primer, bitumen, and mastics.

C. Installer's qualification statement.

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1.6 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with at least five (5) years of documented experience and approved by manufacturer.

1.7 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 BITUMINOUS DAMPPROOFING

A. Bituminous Dampproofing: Cold-applied water-based emulsion; asphalt with mineral colloid or chemical emulsifying agent; with fiber reinforcement; asbestos-free; suitable for application on vertical and horizontal surfaces, by brush or spray; and complying with the following:

1. Asphalt Type(s):

a. Asphalt-Base Emulsion Coating: ASTM D1187/D1187M, Type I - Continuous water exposure within few days after drying.

b. Emulsified Asphalt Coating: ASTM D1227/D1227M, Type II, Class 1 - Mineral colloid emulsifying agents with non-asbestos fibers.

2. VOC Content: Not more than permitted by local, State, and federal regulations.

3. Applied Thickness (per Coat): 1/16 inch (60 mils), minimum, wet film.

4. Products:

a. (Basis of Design) Henry Company; HE789 Fibered Asphalt Emulsion Damp Proofing: www.henry.com.

b. Karnak Corporation; 220 Fibered Emulsion Dampproofing: www.karnakcorp.com.

c. Sika Corporation; Sikalastic-315 (fka MSeal 615): usa.sika.com.

d. W. R. Meadows, Inc; Sealmastic Emulsion Type II (brush/spray-grade): www.wrmeadows.come.

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

5. Source Limitations: Furnish products produced by single manufacturer and obtained from single supplier.

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

2.2 ACCESSORIES

A. Protection Board: Rigid insulation; see Section 07 21 00.

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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. General: Apply two coats of asphalt dampproofing.

B. Foundation Walls: Patch disturbed areas of existing dampproofing with two additional coats of dampproofing of the same generic type.

C. Perform this work in accordance with manufacturer's instructions.

D. Prime surfaces at a rate approved by manufacturer for application indicated, and allow primer to dry thoroughly.

E. Apply bitumen by spray or brush.

F. Apply from 2 inches below finish grade elevation down to top of footings.

G. Seal items watertight with mastic, that project through dampproofing surface.

H. Place protection board directly over dampproofing, butt joints, and adhere to tacky dampproofing.

I. Scribe and cut boards around projections, penetrations, and interruptions.

END OF SECTION

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SECTION 07 21 00 - THERMAL INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Extruded polystyrene (XPS) foam board.

B. Mineral fiber board insulation.

C. Mineral fiber batt insulation.

1.2 RELATED REQUIREMENTS

A. Section 07 21 19 - Foamed-In-Place Insulation.

B. Section 07 27 23 - Gypsum Sheathing Air Barriers: Separate air barrier materials.

C. Section 07 54 00 - Thermoplastic Membrane Roofing: Polyiso insulation board insulation over low slope roof deck.

D. Section 09 21 16 - Gypsum Board Assemblies: Acoustical insulation (sound batt).

1.3 DEFINITIONS

A. Mineral Fiber Material Composition: Insulation referred to as mineral fiber block, board, and blanket insulation is composed of fibers from mineral based substances such as rock, slag, or glass and processed from the molten state into fibrous form.

1. Based on type of insulation substance, the material will be referred to as a mineral fiber when having a rock or slag base, and glass fiber with a glass or silica sand base, also considered a mineral.

2. Insulation blankets are flexible units consisting of felted, bonded, or unbonded fibers formed into rolls or flat cut pieces referred to as batts; rolls are simply longer versions of batts.

3. For additional information about mineral fiber and the various classification types, refer to the following reference standards; ASTM C553, ASTM C612, ASTM C665, and ASTM C726.

1.4 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2024.

C. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2017).

D. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.

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E. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

F. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.

G. ASTM C726 - Standard Specification for Mineral Wool Roof Insulation Board; 2024.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Product Test Reports or Manufacturers' Certificates: Certify that products of this section meet or exceed specified requirements for tests performed by a qualified testing agency.

1.6 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.1 APPLICATIONS

A. Extruded Polystyrene (XPS) Board:

1. Under concrete slabs-on-grade.
2. Foundation perimeters below grade.
3. Component of built-in roof gutters.

B. Mineral Fiber Board:

1. Continuous insulation over sheathing at metal stud framed exterior walls.

C. Mineral Fiber Batt:

1. Insulation in stud cavities of framed walls.

2.2 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:
   a. Typical: Type IV, 25 psi (173 kPa)
   b. High PSI: Type VII, 60 psi (414 kPa), minimum.
2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.

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3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
4. Thermal Resistance, R-value: R-5.0 (0.88), minimum, per 1 inch thickness at 75 degrees F mean temperature.
5. Board Thickness: As indicated on drawings.
6. Board Edges: Square.
7. Products:
    a. DuPont de Nemours, Inc; Styrofoam Brand Square Edge: building.dupont.com.
    b. Kingspan Insulation LLC; GreenGuard XPS Type IV, 25 psi: www.kingspan.com.
    c. Owens Corning Corporation; FOAMULAR Type IV Extruded Polystyrene (XPS) Insulation: www.ocbuildingspec.com.
    d. Substitutions: See Section 01 60 00 - Product Requirements.

2.3 MINERAL FIBER BOARD INSULATION MATERIALS

A. Mineral Wool Board Thermal Insulation: Complying with ASTM C612 or ASTM C553.
1. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
2. Board Thickness: As indicated on drawings.
3. Thermal Resistance: R-value of 4.2 per inch at 75 degrees F, minimum, when tested in accordance with ASTM C518.
4. Maximum Density: 8 pcf, nominal.
5. Products:
    a. Johns Manville; MinWool Curtainwall 40: www.jm.com.
    b. ROCKWOOL; CURTAINROCK 40: www.rockwool.com.
    c. Thermafiber, Inc; FireSpan 40: www.thermafiber.com.
    d. Substitutions: See Section 01 60 00 - Product Requirements.

2.4 MINERAL FIBER BLANKET INSULATION MATERIALS

A. Mineral Wool Blanket Thermal Insulation: Flexible or semi-rigid preformed insulation, complying with ASTM C665.
1. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
2. Thickness: As indicated on drawings.

2.5 ACCESSORIES

A. Support for Cladding and Continuous Insulation: Continuous thermal Z-girts.
1. Fiberglass reinforced plastic (FRP) girts that provide cladding attachment support for exterior wall cladding and metal wall panels.
2. Depth: As required for thickness of insulation.
3. Spacing: 16 inches on center, vertically or horizontally as indicated on drawings.

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4. Fasteners: As recommended by clip manufacturer.
5. Products:
    a. Advanced Architectural Products, LLC; GREENGirt CMH: www.greengirt.com.
    b. Armatherm; Z Girt Structural Thermal Break: www.armatherm.com.
    c. Cladiator; Slotted-Z FG: www.cladiator.com.
    d. exo Surfaces; exoGIRT: www.exo-surfaces.com.
    e. Substitutions: See Section 01 60 00 - Product Requirements.

B. Adhesive: Gun grade, interior and exterior, and compatible with insulation and substrates; complies with ASTM C557.
    1. Application Temperature: 40 to 100 degrees F at contact surfaces.

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.

B. Verify substrate surfaces are flat, free of irregularities.

3.2 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Adhere a 6 inches wide strip of polyethylene sheet over construction, control, and expansion joints with double beads of adhesive each side of joint.

B. Apply adhesive to back of boards:
    1. Three continuous beads per board length.

C. Install boards on foundation perimeter.
    1. Place boards to maximize adhesive contact.
    2. Install in running bond pattern.
    3. Butt edges and ends tightly to adjacent boards and to protrusions.

D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.3 BOARD INSTALLATION USING CLADDING AND CONTINUOUS INSULATION SUPPORTS

A. Install supports in accordance with manufacturer's installation instructions.

B. Install supports in compliance with system orientation, sizes, and locations as indicated on drawings and in accordance with approved shop drawings.

C. Install supports to fill in exterior wall spaces without gaps or voids in insulation.

D. Trim insulation neatly to fit spaces and provide a continuous thermal layer.

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3.4 BOARD INSTALLATION UNDER CONCRETE SLABS

A. Place insulation under slabs on grade after base for slab has been compacted.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

3.5 BATT INSTALLATION

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

B. Install at locations indicated on drawings, in exterior wall and cavity 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. Retain insulation batts in place with spindle fasteners at 12 inches on center.

3.6 PROTECTION

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

END OF SECTION

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SECTION 07 21 19 - FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Foamed-in-place insulation.

1. At junctions of dissimilar wall and roof assemblies.
2. At underside of roof decks.
3. Locations indicated on drawings.

B. Protective intumescent coating.

1.2 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants for low-expanding flexible spray-foam for sealing shim spaces and other .

1.3 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

B. ASTM C1029 - Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation; 2025.

C. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2025.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

E. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

F. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

G. NFPA 275 - Standard Method of Fire Tests for the Evaluation of Thermal Barriers; 2022.

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

I. OBC-2024 - 2024 Ohio Building Code; 2024.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements.

C. Certificates: Certify that products of this section meet or exceed specified requirements.

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D. Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

E. Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of all contractor accreditation and installer certification on site during and after installation. Present on-site documentation upon request.

1.5 QUALITY ASSURANCE

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

B. Installer Qualifications: Company specializing in performing work of the type specified, with minimum three years documented experience, and approved by manufacturer.

C. Air Barrier Association of America (ABAA) Evaluated Materials Program (EAP); www.airbarrier.org: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

1.6 FIELD CONDITIONS

A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.

B. Do not apply foam when temperature is within 5 degrees F of dew point.

PART 2 PRODUCTS

2.1 MATERIALS

A. Closed-Cell Foamed-In-Place Insulation: ASTM C1029, Type II, 1.5 lb/cu. ft. minimum density, rigid or semi-rigid, closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.

1. Thermal Resistance: Aged R-value of 6.0, minimum, per 1 inch thickness at 75 degrees F mean temperature when tested in accordance with ASTM C518.

2. Water Vapor Permeance: Vapor retarder; 2 perms, maximum, when tested at intended thickness in accordance with ASTM E96/E96M, desiccant method.

3. Water Absorption: Less than 2 percent by volume, maximum, when tested in accordance with ASTM D2842.

4. Air Permeance: 0.004 cfm per square foot, maximum, when tested at intended thickness in accordance with ASTM E2178 at 1.57 psf.

5. Closed Cell Content: At least 90 percent.

6. Surface Burning Characteristics: Flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.

7. Products:

a. BASF Corporation; WALLTITE US: www.spf.basf.com.

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b. Carlisle Spray Foam Insulation; SealTite PRO Closed Cell: www.carlislesfi.com.

c. Preferred Solutions, Inc; Staycell 265 Spray Foam Insulation: www.preferredsolutions.net.

d. Universal Polymers Corporation (UPC); UPC 2.0 HFO: www.upcfoam.com.

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

2.2 ACCESSORIES

A. Primer: As required by insulation manufacturer.

B. Protective Coating: Intumescent coating of type recommended by insulation manufacturer formulated for application over polyurethane foam plastics, compatible with insulation, and complies with "2603.9 Special Approval" of OBC-2024.

1. Coating Type: Single component, water-based.

2. Protected Insulation Type: Spray polyurethane foam (SPF).

3. Application: Apply using brush, roller, or airless sprayer.

4. Large-Scale Fire Tests: Passes NFPA 275, NFPA 286 (with the acceptance criteria of OBC-2024, Section 803.1.2.1), FM 4880, UL 1040, or UL 1715 when tested as part of an approved assembly.

5. Products:

a. International Fireproof Technology Inc; DC315 Intumescent Coating: www.painttoprotect.com.

b. International Coatings Group; FBL-100 Fire Barrier Latex: www.internationalcoatingsgroup.com.

c. No-Burn, Inc; Plus ThB Intumescent Coating: www.noburn.com.

6. Minimum Thickness: 4 mils wet; 3 mils dry.

PART 3 EXECUTION

3.1 EXAMINATION

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

B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation adhesion.

3.2 PREPARATION

A. Mask and protect adjacent surfaces from over spray or dusting.

B. Apply primer in accordance with manufacturer's instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.3 APPLICATION

A. Apply insulation in accordance with manufacturer's instructions.

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B. Apply insulation by spray method, to envelop entire area to be insulated to a uniform monolithic density without voids.

C. Where not otherwise covered with gypsum wallboard, apply coating monolithically, without voids, to fully cover foam insulation.

D. Patch damaged areas.

E. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.

3.4 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Field inspections and tests will be performed by an independent testing agency.

C. Inspection will include verification of insulation and protective coating thickness and density.

3.5 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION

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SECTION 07 27 23 - GYPSUM SHEATHING AIR BARRIERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air barrier assembly, including the following materials:

1. Gypsum sheathing with integral air barrier.
2. Air barrier accessories and transition materials.

1.2 RELATED REQUIREMENTS

A. Section 07 21 19 - Foamed-In-Place Insulation: Spray-applied closed-cell foam air barrier material.

B. Section 07 54 00 - Thermoplastic Membrane Roofing: Vapor retarding air-barrier membrane component of roofing assembly.

1.3 DEFINITIONS

A. ABAA: The Air Barrier Association of America, Inc: www.airbarrier.org.

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

C. Air-Barrier Accessory: Transitional components that provides continuity between separate air barrier materials.

D. Air-Barrier Material: Primary components installed to provide a continuous barrier to the movement of air.

E. Air-Barrier System: The whole collection of airtight building components and assemblies, including joints, junctures, and transitions between air barrier materials, connecting with other air impermeable components of the building enclosure to control air movement through the building envelope.

1.4 REFERENCE STANDARDS

A. ABAA Certification - Air Barrier Installer Certification; current.

B. ABAA Evaluated Air Barrier Assemblies - Air Barrier Association of America (ABAA) Evaluated Air Barrier Materials Assemblies; current.

C. ABAA S0005 - Standard for Air Barrier Material – Non-Insulating Sheathing - Gypsum Based - Material Specification; 2019.

D. ABAA T0004 - Standard Test Method for Determining Gap Bridging Ability of Air and Water Resistive Barrier Materials; 2021.

E. ABAA T0011 - Standard Test Method for Determining the Air Leakage Rate Caused by Fasteners Penetrating the Air Barrier (AB) or Air and Water-Resistive Barrier (AWRB); 2024.

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F. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2024.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

I. ASTM E779 - Standard Test Method for Determining Air Leakage Rate by Fan Pressurization; 2019.

J. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

K. ASTM E2357 - Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies; 2025.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate installation of air barrier products with framing installation and subsequent operations that impact finished envelope air-barrier assembly, to accomplish an airtight building enclosure that controls infiltration or exfiltration of air.

1. Services include coordination between the trades, the proper scheduling and sequencing of the work, preconstruction meetings, inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. They do not include contract enforcement activities performed by Architect.

2. Ensure that the intent of constructing the building enclosure with a continuous air barrier system to control air leakage into, or out of the conditioned space is achieved. The air barrier system shall have the following characteristics:

a. It must be continuous, with all joints sealed.

b. It must be structurally supported to withstand positive and negative air pressures applied to the building enclosure.

c. Connection shall be made between:

1) Foundation and walls.

2) Walls and windows or doors.

3) Different wall systems.

4) Wall and roof.

5) Wall and roof over unconditioned space.

6) Walls, floor and roof across construction, control and expansion joints.

7) Walls, floors and roof to utility, pipe and duct penetrations.

3. Ensure coordination between subcontractors required to provide an airtight building enclosure; that all penetrations of the air barrier and paths of air infiltration and exfiltration are sealed.

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B. Preinstallation Meetings: Conduct a preinstallation meeting at least one month prior to the start of the work of this section; require attendance by all affected installers, the trades involved in the whole building air barrier system; discuss where each trade begins and ends; discuss the responsibility and installation sequence for air-tight joints, junctures, and transitions between materials and assemblies to be installed by the different trades, specified in this and other Sections.

1. Agenda to include, but not limited to, review of the following:

a. Joints between air barrier assemblies and material transitions to abutting construction.

b. Requirements for forming and sealing penetrations of air barrier by other trades.

c. Installation sequence of materials comprising air barrier assemblies.

d. Project and manufacturer's details.

e. Mockups, testing, and inspection requirements.

f. Coordination and sequencing of air barrier work with work of other Sections

C. Sequencing: Install air barrier assembly before materials that covers it.

D. Scheduling: Ensure exposure period does not exceed material manufacturer's time limit.

1.6 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on air barrier assembly, products and materials; including material characteristics, performance criteria, limitations, certification of material compatibility, and accessories.

C. Shop Drawings: Provide drawings of air barrier assembly joints, flashing and counterflashing rough openings, sealing penetrations, inside and outside corners, terminations, and special joint conditions. Include details of interfaces with other materials that form part of each air barrier assembly and the building air barrier system.

D. Certificate: Certify that products of this section meet or exceed specified requirements and interfacing materials have passed compatibility testing.

E. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

F. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification; keep copies of each contractor accreditation and installer certification on site during and after installation, and present on-site documentation upon request.

1.7 QUALITY ASSURANCE

A. ABAA Evaluated Air Barrier Assemblies: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.

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B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience, current ABAA Certification, and approved by manufacturer.

C. Manufacturer Qualification: Company specializing in manufacturing products specified in this section, with minimum ten (10) years of documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in manufacturer's unopened containers, pallets, or panels fully identified with name, brand, type, and grade.

B. Store products under cover and elevated above grade in a dry ventilated space to protect against moisture. Support stacked products to prevent deformation and allow air circulation.

1.9 FIELD CONDITIONS

A. Ambient Conditions: Do not install fluid-applied flashings or sealants when the ambient temperature is below 40 degrees F.

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

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Air Barrier Assembly - Scope of Work:

1. Services include coordination between the trades, the proper scheduling and sequencing of the work, preconstruction meetings, inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities.

2. Services do not include contract enforcement activities performed by Architect.

3. Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration.

4. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration.

B. Air Leakage Limits:

1. Air Barrier Assembly Air Permeance: The assemblies of materials and components shall have an air permeance not to exceed 0.04 cfm/sq ft under a pressure differential of 0.3 inches of water (1.57 psf) when tested in accordance with ASTM E2357.

2. Air Barrier System Air Permeance: The air leakage of the entire building shall not exceed 0.04 cfm/sq ft under a pressure differential of 0.3 inches of water (1.57 psf) when tested according to ASTM E779.

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3. Material Air Permeance: As indicated for each material specified under Article 2.2, below.

2.2 AIR BARRIER PRIMARY MATERIALS

A. Gypsum Sheathing Air Barrier: Vapor semi-permeable, complying with ABAA S0005 and ASTM C1177/C1177M physical requirements for glass-mat faced gypsum panels.

1. Thickness: 1/2 inch.
2. Edges: Square.
3. Material Air Permeance: 0.004 cfm/sq ft 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
4. Water Vapor Permeance: 4.89 perms, minimum, when tested in accordance with ASTM E96/E96M using Procedure B - Water Method, at 73.4 degrees F.
5. Water Penetration Resistance Around Fasteners: Pass, when tested in accordance with ABAA T0011.
6. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A when tested in accordance with ASTM E84.
7. Seam and Perimeter Detailing: As recommended by manufacturer.
8. Products:
    a. Georgia-Pacific Gypsum LLC; DensElement Barrier System: www.buildgp.com/denselement.
    b. (Basis of Design) Tremco/USG Corporation; Securock ExoAir 430 Panel: www.usg.com.

2.3 AIR BARRIER ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Air Barrier and Adjacent Substrates: As indicated or in compliance with air barrier manufacturer's installation instructions.

1. Gypsum Sheathing Air Barrier - Panel Treatment: Use manufacturer-recommended sealant, transition strips, flashing sheets, termination bars, patching materials, and adhesive tapes at control joints, panel connections, and penetrations.

B. Preformed Transition Membrane: Semirigid precured silicone sheet, high movement capacity +200/-50 percent, tapered edges, with or without ribbed back, tear resistant; with manufacturer's recommended adhesive.

1. Products:
    a. Dow; DOWSIL Silicone Transition Strip and System: www.dow.com.
    b. Momentive Performance Materials, Inc/GE Silicones; GE UltraSpan UST2200 Transition Sheets: www.siliconeforbuilding.com.
    c. Pecora Corporation; XL-SPAN Pre-formed Silicone Transition Membrane: www.pecora.com.

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d. (Basis of Design) Tremco/USG Corporation; ProGlaze ETA Connections: www.tremcosealants.com.

e. VaproShield, LLC; VaproSilicone Transition Materials: www.vaproshield.com.

C. Stainless Steel Flashing: Flexible flashing with 2 mil, 0.002 inch thick Type 304 stainless steel sheet, 8 mil, 0.008 inch of butyl adhesive and siliconized release liner.

1. Width: 18 inches wide, or as required for applications indicated on drawings.

2. Gap Bridging Ability: Pass, when tested in accordance with ABAA T0004.

3. Overlap joints at least 2 inches.

4. Products:

a. Momentive Performance Materials, Inc/GE Silicones; GE Elemax SS Flashing: www.siliconeforbuilding.com.

D. Liquid Flashing: One part, fast curing, nonsag, gun grade, trowelable.

1. Gap Bridging Ability: Pass, when tested in accordance with ABAA T0004.

2. Products:

a. Master Builders Solutions; MasterSeal AWB 900: www.master-builders-solutions.com/en-us.

b. Momentive Performance Materials, Inc/GE Silicones; Elemax 5000 Liquid-Applied Flashing: www.siliconeforbuilding.com.

c. Pecora Corporation; XL-Flash: www.pecora.com.

d. (Basis of Design) Tremco/USG Corporation; Dymonic 100: www.tremcosealants.com.

e. W. R. Meadows, Inc; Air-Shield Liquid Flashing: www.wrmeadows.com.

E. Gypsum Sheathing Air Barrier - Sealants:

1. Medium-modulus polyurethane for use in joints, penetrations, and transition areas.

a. (Basis of Design) Tremco/USG Corporation; Dymonic 100.

2. Ultra-low modulus silicone for adhering connections to panels.

a. (Basis of Design) Tremco/USG Corporation; Spectrem 1.

F. Mechanical Fasteners and Anchors: Comply with manufacturer's written recommendations for fastener sizes, types, and other requirements.

1. Material: Stainless steel, Type 304.

2. Anchors:

a. Toggle bolt type for anchorage to hollow masonry.

b. Expansion shield and lag bolt type for anchorage to solid masonry or concrete.

c. Bolt or ballistic fastener for anchorage to steel.

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PART 3 EXECUTION

3.1 GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

3.2 EXAMINATION

A. Verify that surfaces and conditions are ready for work of this section.

B. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.

C. Do not proceed with this work until unsatisfactory conditions have been corrected.

3.3 PREPARATION

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

B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's installation instructions.

3.4 INSTALLATION

A. Install materials in accordance with manufacturer's installation instructions.

B. Air Barriers: Install continuous airtight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.

D. Gypsum Sheathing Air Barrier: Secure panels to studs in accordance with manufacturer's installation instructions.

1. Prepare substrate in accordance with board manufacturer's installation instructions.
2. Verify that penetrating items are in place.
3. Use maximum board lengths to minimize number of joints.
4. Locate end joints over framing. Center end joints over supports and stagger in each course.
5. Secure sheathing directly to framing using manufacturer's recommended screw-fastener with washer.
    a. Fastener spacing in accordance with manufacturer's instructions.
    b. Install with air barrier facer on exterior side of sheathing.

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c. Cut and space edges of panels to match spacing of structural support elements.

6. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.
   a. Provide 1/2-inch gap at concrete and unit masonry construction.
7. Seal joints and penetrations with manufacturer's liquid flashing, seam sealants, and transition membranes; comply with ASTM E2357.
   a. Apply accessories and transition materials at penetrations, gaps, and cracks to form continuous airtight surface.
   b. Seal panel edges, joints, and through wall penetrations.
   c. Install liquid flashing or flashing tape in a shingle fashion. Overlap tape joints by the width of the tape; i.e. 4 inch tape is overlapped 4 inch.
   d. Coordinate the installation of air-barrier-faced sheathing with installation of roofing air-barrier membrane to ensure continuity of air barrier from wall to roof assembly.
      1) Install transition strip on roofing air-barrier membrane so that a minimum of 3 inches of coverage is achieved over each substrate.
      2) Connect and seal sheathing material continuously to air barriers specified under other Sections as well as to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
   e. Seal around masonry reinforcing or ties and penetrations with liquid flashing compound.
   f. Seal top of through-wall flashings to sheathing with an additional 6-inch-wide, air barrier transition material.
   g. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with liquid flashing compound.

E. Openings and Penetrations in Exterior Air Barriers:
1. Apply continuous, unbroken coating of liquid flashing compound to concealed perimeter of rough framed surfaces overlapping frames of doors, windows, storefronts, curtain walls, and louvers a minimum of 3 inches and extending to surrounding exterior wall substrates so that a minimum of 3 inches of coverage is achieved over each substrate.
2. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, doors, and miscellaneous penetrations of sheathing material with low-expanding foam sealant, comply with Section 07 92 00.
3. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto air barrier and at least 6 inches up jambs; mechanically fasten stretched edges.

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4. At openings with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
5. At openings with nonflanged frames, seal air barrier to each side of framing at opening using flashing at least 9 inches wide, and covering entire depth of framing.
6. At head of openings, install flashing under air barrier extending at least 2 inches beyond face of jambs; seal air barrier to flashing.
7. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
8. Service and Other Penetrations: Form flashing around penetrating item and seal to air barrier surface.

3.5 PROTECTION

A. Protect installed air barrier assembly from damage due to subsequent construction operations.

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

END OF SECTION

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SECTION 07 42 13.23 - METAL COMPOSITE MATERIAL WALL PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Exterior Wall System Type X02; consisting of formed metal composite material (MCM) sheet, secondary supports, and anchors to structure.

B. Matching flashing and trim.

1.2 RELATED REQUIREMENTS

A. Section 05 05 13 - Shop-Applied Coatings for Metal: Custom finish and color.

B. Section 07 21 00 - Thermal Insulation: Support for cladding and continuous insulation.

C. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashing components integrated with this wall system.

1.3 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

D. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2025.

E. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; 2025b.

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

G. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

H. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2025a.

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

J. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

K. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

L. ASTM D1781 - Standard Test Method for Climbing Drum Peel for Adhesives; 1998 (Reapproved 2021).

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M. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics; 2023.

N. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting: Convene before starting work of this section to verify project requirements, coordinate with installers of other work, establish condition and completeness of building substrate, and review manufacturers' installation instructions and warranty requirements.

1. Require attendance by the installer and relevant sub-contractors.
2. Include MCM sheet manufacturer’s representative and wall system manufacturer’s representative to review storage and handling procedures.
3. Review in detail truck transportation, parking, vertical transportation, schedule, personnel, installation of adjacent materials and substrate.
4. Review procedures for protection of work and other construction.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data - MCM Sheets: Manufacturer's data sheets on each product to be used, including thickness, physical characteristics, and finish, and:

1. Finish manufacturer's data sheet showing physical and performance characteristics.
2. Storage and handling requirements and recommendations.
3. Fabrication instructions and recommendations.
4. Specimen warranty for finish, as specified herein.

C. Product Data - Wall System: Manufacturer's data sheets on each product to be used, including:

1. Physical characteristics of components shown on shop drawings.
2. Storage and handling requirements and recommendations.
3. Installation instructions and recommendations.

D. Shop Drawings: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, support clips, number of anchors, supports, reinforcement, trim, flashings, and accessories.

1. Indicate panel numbering system.
2. Differentiate between shop and field fabrication.
3. Indicate substrates and adjacent work with which the wall system must be coordinated.
4. Include large-scale details of anchorages and connecting elements.
5. Include large-scale details or schematic, exploded or isometric diagrams to fully explain flashing at a scale of not less than 1-1/2 inches per 12 inches.

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E. Color Samples: Comply with Section 05 05 13.

F. Manufacturer's Field Reports: Provide within 48 hours of field review. State what was observed and what changes, if any, were requested or required.

G. Installer's qualification statement.

H. Maintenance Data: Care of finishes and warranty requirements.

1.6 QUALITY ASSURANCE

A. Field Measurements: Verify actual dimensions by field measurement before fabrication; show recorded measurements on shop drawings.

B. Manufacturer Qualifications: Company specializing in manufacturing wall panel systems specified in this section.

1. With not less than ten (10) years of documented experience.

2. Approved by MCM sheet manufacturer.

3. Submit contact names and phone numbers for at least three references connected with successful past projects.

C. Installer Qualifications: Company specializing in performing work of type specified in this section.

1. With minimum five years of documented experience.

2. Approved by wall panel system manufacturer.

3. Submit contact names and phone numbers for at least three references connected with successful past projects.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.

1. Protect finishes by applying heavy-duty removable plastic film during production.

2. Package for protection against transportation damage.

3. Provide markings to identify components consistently with drawings.

4. Exercise care in unloading, storing, and installing panels to prevent bending, warping, twisting, and surface damage.

B. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

1. Store in well-ventilated space out of direct sunlight.

2. Protect from moisture and condensation with tarpaulins or other suitable weathertight covering installed to provide ventilation.

3. Store at a slope to ensure positive drainage of accumulated water.

4. Do not store in enclosed space where ambient temperature can exceed 120 degrees F.

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5. Avoid contact with other materials that might cause staining, denting, or other surface damage.

1.8 FIELD CONDITIONS

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

1.9 WARRANTY

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

B. Finish Warranty: Comply with Section 05 05 13.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Metal Composite Material (MCM) Sheet:

1. (Basis of Design) ALUCOBOND by 3A Composites USA; ALUCOBOND PLUS: www.alucobondusa.com.
2. ALPOLIC Materials; ALPOLIC/fr (Fire Retardant core): www.alpolic-americas.com.
3. Arconic Architectural Products LLC; REYNOBOND 4mm FR Composite Material: www.arconic.com.
4. Fairview Architectural LLC; VitraBond (Fire Rated): www.fairview-na.com.
5. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 WALL PANEL SYSTEM

A. Wall Panel System: Metal panels, fasteners, and anchors designed to be supported by framing or other substrate provided by others; provide installed panel system capable of maintaining specified performance without defects, damage, or failure.

1. Provide panel jointing and weatherseal using reveal joints and gaskets but no sealant.
2. Anchor panels to supporting framing without exposed fasteners.

2.3 PERFORMANCE REQUIREMENTS

A. Thermal Movement: Provide for free and noiseless vertical and horizontal thermal movement due to expansion and contraction under material temperature range of minus 20 degrees F to 180 degrees F without buckling, opening of joints, undue stress on fasteners, or other detrimental effects; allow for ambient temperature at time of fabrication, assembly, and erection procedures.

1. Design Wind Pressure: In accordance with local building code.
2. Maximum deflection of perimeter framing member of L/175 normal to plane of the wall; maximum deflection of individual panels of L/60.

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3. Maximum anchor deflection in any direction of 1/16 inch at connection points of framing members to anchors.

2.4 PANELS

A. Panels: 2-inch- deep pans formed of metal composite material sheet by routing back edges of sheet, removing corners, and folding edges.

1. Reinforce corners with riveted aluminum angles.
2. Provide concealed attachment to supporting structure by adhering attachment members to back of panel; attachment members may also function as stiffeners.
3. Maintain maximum panel bow of 0.8 percent of panel dimension in width and length; provide stiffeners of sufficient size and strength to maintain panel flatness without showing local stresses or read-through on panel face.
4. Secure members to back face of panels using structural silicone sealant approved by MCM sheet manufacturer.
5. Fabricate panels under controlled shop conditions.
6. Where final dimensions cannot be established by field measurement before commencement of manufacturing, make allowance for field adjustments without requiring field fabrication of panels.
7. Fabricate as indicated on drawings and as recommended by MCM sheet manufacturer.
    a. Make panel lines, breaks, curves, and angles sharp and true.
    b. Keep plane surfaces free from warp or buckle.
    c. Keep panel surfaces free of scratches or marks caused during fabrication.
8. Provide joint details providing a watertight and structurally sound wall panel system that allows no uncontrolled water penetration on inside face of panel system.
9. For "dry" jointing, secure extrusions to returned pan edges with stainless steel rivets; provide means of concealed drainage with baffles and weeps for water that might accumulate in members of system.

2.5 MATERIALS

A. Metal Composite Material (MCM) Sheet: Two sheets of aluminum sandwiching a core of extruded thermoplastic material; no foamed insulation material content.

1. Overall Sheet Thickness: 0.118 inch, minimum.
2. Bond and Peel Strength: No adhesive failure of the bond between the core and the skin nor cohesive failure of the core itself below 22.4 inch-pound/inch with no degradation in bond performance, when tested in accordance with ASTM D1781, simulating resistance to panel delamination, after 8 hours of submersion in boiling water and after 21 days of immersion in water at 70 degrees F.
3. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.

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4. Flammability: Self-ignition temperature of 650 degrees F or greater when tested in accordance with ASTM D1929.

B. Metal Framing Members: Include sub-girts, zee-clips, base and sill angles and channels, hat-shaped and rigid channels, and furring channels required for complete installation.

1. Provide material strength, dimensions, configuration as required to meet applied loads and in compliance with applicable building code.

2. Sheet Steel Components: ASTM A653/A653M galvanized to G90/Z275 or zinc-iron alloy-coated to A60/ZF180; or ASTM A792/A792M aluminum-zinc coated to AZ60/AZM180.

3. Aluminum Components: ASTM B209/B209M; or ASTM B221 (ASTM B221M).

2.6 FINISHES

A. (MTL-2) Fluoropolymer Coil Coating System: See Section 05 05 13.

2.7 ACCESSORIES

A. Flashing: Sheet aluminum; 0.040 inch thick, minimum; finish and color to match MCM sheet; see Section 07 62 00 for additional requirements.

B. Support for Cladding and Continuous Insulation: See Section 07 21 00.

C. Anchors, Clips, and Accessories: Use one of the following:

1. Stainless steel complying with ASTM A276/A276M, ASTM A480/A480M, or ASTM A666/A666M.

2. Steel complying with ASTM A36/A36M and hot-dip zinc coating to ASTM A153/A153M.

3. Steel complying with ASTM A36/A36M and hot-dip galvanized to ASTM A123/A123M, with Coating Thickness Grade of 100.

D. Fasteners:

1. Exposed Fasteners: Not permitted.

2. Screws: Self-drilling or self-tapping Type 410 stainless steel or zinc-alloy steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal wall panels.

3. Bolts: Stainless steel.

4. Fasteners for Flashing and Trim: Blind fasteners of high-strength aluminum or stainless steel.

E. Provide panel system manufacturer's and installer’s standard corrosion resistant accessories, including fasteners, clips, anchorage devices, and attachments.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine dimensions, tolerances, and interfaces with other work.

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B. Examine substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturer's written instructions.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

D. Notify Architect in writing of conditions detrimental to proper and timely completion of work, and do not proceed with erection until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect adjacent work areas and finish surfaces from damage during installation.

3.3 INSTALLATION

A. Do not install products that are defective, including warped, bowed, dented, and broken members, and members with damaged finishes.

B. Support for Cladding and Continuous Insulation: Install in accordance with approved shop drawings and manufacturer's written instructions; securely fasten; shim and level to uniform plane.

C. Install panels in accordance with manufacturer's instructions and approved shop drawings.

D. Install wall system securely allowing for necessary thermal and structural movement; comply with wall system manufacturer's instructions for installation of concealed fasteners.

E. Do not handle or tool products during erection in manner that damages finish, decreases strength, or results in visual imperfection or failure in performance. Return component parts that require alteration to shop for refabrication, if possible, or for replacement with new parts.

F. Do not form panels in field unless required by wall system manufacturer and approved by the Architect; comply with MCM sheet manufacturer's instructions and recommendations for field forming.

G. Separate dissimilar metals; use gasket fasteners, isolation shims, or isolation tape where needed to eliminate possibility of electrolytic action between metals.

H. Install flashings as indicated on shop drawings. At flashing butt joints, provide a lap strap under flashing and seal lapped surfaces with a full bed of non-hardening sealant.

I. Install square, plumb, straight, and true, accurately fitted, with tight joints and intersections maintaining the following installation tolerances:

1. Variation From Plane or Location: 1/2 inch in 30 feet of length and up to 3/4 inch in 300 feet, maximum.

2. Deviation of Vertical Member From True Line: 0.1 inch in 25 feet run, maximum.

3. Deviation of Horizontal Member From True Line: 0.1 inch in 25 feet run, maximum.

4. Offset From True Alignment Between Two Adjacent Members Abutting End To End, In Line: 0.03 inch, maximum.

J. Replace damaged products.

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1. Exception: Field repairs of minor damage to finishes are permitted only when approved in writing by Architect, panel manufacturer, and fabricator.
2. Field Repairs to Finishes: Using materials and methods sufficient that repairs are not discernible when viewed at distance of 10 feet under all typical light conditions experienced at the project.

3.4 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Wall System Manufacturer's Field Services: Provide field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with instructions.

3.5 CLEANING

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

B. Ensure weep holes and drainage channels are unobstructed and free of dirt and sealants.

C. Remove protective film after installation of joint sealers, after cleaning of adjacent materials, and immediately prior to completion of work.

D. Remove temporary coverings and protection of adjacent work areas.

E. Clean installed products in accordance with manufacturer's instructions.

3.6 PROTECTION

A. Protect installed panel system from damage until Date of Substantial Completion.

END OF SECTION

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SECTION 07 42 43.11 - HIGH PRESSURE LAMINATE (HPL) WALL PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. (EWD-1) Drained and back ventilated rainscreen HPL panel cladding system.

1.2 RELATED REQUIREMENTS

A. Section 07 21 00 - Thermal Insulation: Support for cladding and continuous insulation.

B. Section 07 62 00 - Sheet Metal Flashing and Trim: Formed sheet metal fabrications.

1.3 REFERENCE STANDARDS

A. AAMA 509 - Voluntary Test and Classification Method for Drained and Back Ventilated Rainscreen Wall Cladding Systems; 2022.

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

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

F. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

G. EN 438-6 - High-pressure decorative laminates (HPL) - Sheets based on thermosetting resins (usually called laminates) - Part 6: Classification and specifications for Exterior-grade compact laminates of thickness 2 mm and greater; 2016.

H. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting: Convene before starting work of this section to verify project requirements, coordinate with installers of other work, establish condition and completeness of building substrate, and review manufacturers' installation instructions and warranty requirements.

1. Review procedures for protection of work and other construction.

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1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data - HPL Panels: Manufacturer's data sheets on each product to be used, including thickness, physical characteristics, and finish.

C. Product Data - Panel Support System: Manufacturer's data sheets on each product to be used, including:

1. Physical characteristics of components shown on shop drawings.
2. Storage and handling requirements and recommendations.

D. Shop Drawings: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, support clips, number of anchors, supports, reinforcement, trim, flashings, and accessories.

1. Indicate size, spacing, and location of support and attachment components, connections, and types and locations of fasteners.
2. Indicate necessary provisions for structural and thermal movement between wall panel system and adjacent materials.
3. Indicate locations and sizes of penetrations through wall panel system for Architect's approval.
4. Indicate substrates and adjacent work with which the wall system must be coordinated.
5. Include large-scale details of anchorages and connecting elements.
6. Include large-scale details or schematic, exploded or isometric diagrams to fully explain flashing at a scale of not less than 1-1/2 inches per 12 inches.

E. Samples: Submit two samples of each style and color of panel, 12 by 12 inches in size, showing finish color, sheen, and texture.

F. Fabricator's qualification statement.

G. Installer's qualification statement.

H. Fabricator's Field Reports: Submit weekly reports of site inspection conducted by fabricator's field representative including photographs to verify acceptable quality of this work.

I. Executed warranty.

1.6 QUALITY ASSURANCE

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

B. Fabricator Qualifications: Company specializing in performing work of type specified in this section with minimum five years of documented experience and approved by manufacturer.

C. Installer Qualifications: Company specializing in performing work of type specified in this section with minimum five years of documented experience and approved by manufacturer.

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1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store materials with labels intact in manufacturer's unopened packaging until ready for installation.

B. Store products under waterproof cover, well ventilated, and elevated above grade on flat surface.

C. Protect materials from harmful environmental elements, construction dust, direct sunlight, and other potentially detrimental conditions.

1.8 FIELD CONDITIONS

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

1.9 WARRANTY

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

B. Manufacturer Warranty: Provide manufacturer's warranty for each panel style; covering material failures and agreeing to replace panels that show finish degradation including, but not limited to, peeling, blistering, wrinkling, splitting, splintering, rot, delamination, or loss of color, pattern, or appearance, within specified warranty period of ten (10) years from Date of Substantial Completion. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. (Basis of Design) Trespa North America; Trespa Meteon: www.trespa.com.

B. Abet USA Inc; ABET LAMINATI MEG - Material Exterior Grade: www.abetlaminati.com/en.

C. Fundermax North America Inc; Exterior Phenolic (HPL) Panels: www.fundermax.us.

D. Kronospan LLC; Kronoart Exterior Facades: www.kronospan.com.

E. Parklex Prodema; NATURCLAD- W: www.parklexprodema.com/usa.

2.2 GENERAL

A. Cladding System: Drained and back-ventilated rainscreen, complying with AAMA 509.

1. Cladding includes exterior wall panels, soffit panels, and subgirt framing assembly.

2. Factory-fabricated, prefinished cladding; site assembled.

3. Panel support and concealed fastener system.

B. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.

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2.3 PERFORMANCE REQUIREMENTS

A. Testing of Drained and Back Ventilated Panel System: Submit results in accordance with AAMA 509 test methods for drained and back ventilated panel system similar to system specified.

B. Design and size components to support assembly dead loads and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.

1. Design Wind Loads: Comply with requirements indicated on drawings.
2. Maximum Allowable Deflection of Panels: L/240 for length (L) of span; no permanent deformation of panel system allowed.
3. Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling, dynamic loading and release of loads, and deflection of structural support framing.

C. Surface Burning Characteristics: Maximum flame spread index of 75 or less and maximum smoke developed index of 450, when tested in accordance with ASTM E84 or UL 723.

2.4 HIGH PRESSURE LAMINATE (HPL) PANELS

A. (EWD-1) HPL Panels: Core layer of sheets of kraft paper impregnated with phenolic resins; integral, decorative, melamine finish; manufactured under heat and pressure in compliance with NEMA LD 3, Grade CGS; or in compliance with EN 438-6 Type EDF/EDS.

1. Thickness: 1/2 inch (12mm), nominal.
2. Panel Size: As indicated on drawings.
3. Surface Texture: Smooth; with matte finish.
4. Finish: Manufacturer's standard, single-sided, UV-resistant, decorative finish.
5. Basis of Design:
    a. Trespa Meteon Wood Decors, Denver Oak NW27.

2.5 PANEL SUPPORT SYSTEM

A. Manufacturers:

1. (Basis of Design) Universe Corporation; Universe 8000-285 "Concealed Fastener": www.universecorp.com
2. Substitutions: See Section 01 60 00 - Product Requirements.
    a. For any product not identified as "Basis of Design", submit information as specified for substitutions.

B. Panel Support and Concealed Fastener System: Provide material strength, dimensions, configuration as required to meet applied loads and in compliance with applicable building code. Include sub-girts, clips, and furring channels required for complete installation.

1. Extruded vertical and horizontal aluminum rails, brackets, and clips.
2. Aluminum Components: ASTM B209/B209M; or ASTM B221 (ASTM B221M).

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3. Fasteners: Provide support system and cladding attachment fasteners as recommended by system manufacturer in accordance with requirements.

2.6 FABRICATION

A. Shop-fabricate panels and accessories in accordance with panel manufacturer's written fabrication instructions.

B. Fabricate panel edges to profile indicated, or if not indicated, to profile on approved shop drawings. Raw, as-manufactured panel edges are not permitted.

C. Fabricate true to shape, accurate in size, square, and free from distortion or defects.

D. Verify actual measurements/openings by field measurements performed by the installer prior to fabrication of panels.

1. Indicate field measurements on shop drawings.

2.7 ACCESSORIES

A. Support for Cladding and Continuous Insulation: See Section 07 21 00.

B. Flashing: Sheet aluminum; see Section 07 62 00.

C. Insect Screen: Aluminum mesh, painted where otherwise visible in open panel joints; at least 50 percent open area.

D. Panel to Subframing Fasteners: Stainless steel self-tapping screws, type and style as recommended by panel manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrate; clean and repair to eliminate conditions detrimental to proper installation.

B. Verify that weather-resistive barrier is installed and approved.

C. Do not begin installation until unacceptable conditions are corrected.

3.2 PREPARATION

A. Touch up field cut edges before installing.

B. Protect surrounding areas and adjacent surfaces from damage during execution of work.

3.3 INSTALLATION

A. Install cladding in accordance with manufacturer's installation instructions and approved shop drawings.

B. Ensure that supports for cladding and continuous insulation are plumb and plane.

C. Wall Panels: Lay out panels to butt joints only over framing or blocking; stagger end joints in adjacent and subsequent courses.

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1. Install panels plumb, level, and accurately spaced; so that all joints are true and even throughout the installation. Adjust out of plane panels.
2. Do not install wall panels less than 6 inches above surface of ground or closer than 1 inch to surfaces where water may collect.
3. Allow space for thermal movement at ends of wall panels that butt against trim; seal joint between panel and trim.

D. Sheet Metal Flashing: Install in accordance with wall panel manufacturer's instructions and as indicated on drawings.

3.4 TOLERANCES

A. Installed Tolerance: Not more than 0.072 inch per 3 feet from true line, level, and plumb between fixing points, noncumulative.

3.5 FIELD QUALITY CONTROL

A. Fabricator Services: Provide services of fabricator's field representative to review field procedures and to ensure that handling, installation, application, protection, and cleaning complies with manufacturer's instructions. Provide written reports to Architect.
1. One visit when substrate work is complete and panel materials have been delivered and stored, but before starting cladding work.
2. One visit when cladding work is approximately 25 percent and one when 60 percent complete.
3. One visit when cladding work, including cleaning, is complete.

3.6 CLEANING

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

B. Remove temporary covers and strippable films before installation of panels. Where film occurs on both sides of panels, remove film from both sides simultaneously.

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

D. Clean accumulations of dirt, sealant, and other obstructions from weep holes and drainage channels.

3.7 PROTECTION

A. Protect installed products until Date of Substantial Completion.

END OF SECTION

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SECTION 07 54 00 - THERMOPLASTIC MEMBRANE ROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Adhered system with polyvinyl chloride (PVC) roofing membrane.

B. Insulation, flat and tapered.

C. Air barrier, temporary roof.

D. Deck sheathing, thermal barrier substrate board.

E. Insulation cover board.

F. Flashings.

G. Roofing stack boots and walkway pads.

1.2 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood blocking, cant strips, and nailers.

B. Section 07 71 00 - Roof Specialties: Prefabricated roof edge metal, including gravel stops, copings, and fascias.

1.3 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

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

C. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2024.

D. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2025.

E. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2025.

F. ASTM D4263 - Standard Practice for Indicating Moisture in Concrete by the Plastic Sheet Method; 2024.

G. ASTM D4434/D4434M - Standard Specification for Poly(Vinyl Chloride) Sheet Roofing; 2021.

H. ASTM D6164/D6164M - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements; 2021.

I. ASTM D7635/D7635M - Standard Test Method for Measurement of Thickness of Coatings Over Fabric Reinforcement; 2024.

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J. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

K. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

L. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

M. FM 4474 - American National Standard for Evaluating the Simulated Wind Uplift Resistance of Roof Assemblies Using Static Positive and/or Negative Differential Pressures; 2020.

N. FM DS 1-29 - Roof Deck Securement and Above-Deck Roof Components; 2016, with Editorial Revision (2022).

O. NRCA (RM) - The NRCA Roofing Manual; 2025.

P. UL (FRD) - Fire Resistance Directory; Current Edition.

Q. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies; Current Edition, Including All Revisions.

R. UL 1897 - Uplift Tests for Roof-Covering Systems; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.

1. Meet with Owner, Architect, Construction Manager, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.

2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.

3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.

5. Review structural loading limitations of roof deck during and after roofing.

6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.

7. Review governing regulations and requirements for insurance and certificates if applicable.

8. Review temporary protection requirements for roofing system during and after installation.

9. Review roof observation and repair procedures after roofing installation.

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B. Preinstallation Meeting: Conduct meeting at Project site. Convene one week before starting work of this section.

1. Meet with Owner, Architect, Construction Manager, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review preparation and installation procedures and coordinating and scheduling required with related work.
3. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
4. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
5. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
6. Review structural loading limitations of roof deck during and after roofing.
7. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
8. Review governing regulations and requirements for insurance and certificates if applicable.
9. Review temporary protection requirements for roofing system during and after installation.
10. Review roof observation and repair procedures after roofing installation.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data indicating membrane materials, air barrier, flashing materials, insulation, adhesives, fasteners, and accessories.

C. Shop Drawings: Submit drawings that indicate joint or termination detail conditions, conditions of interface with other materials, and setting plan for tapered insulation. Include roof plans, sections, details, and attachments to other work, with details the following:

1. Layout and thickness of insulation.
2. Base flashings and membrane termination details.
3. Flashing details at penetrations.
4. Tapered insulation layout, thickness, and slopes.
5. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
6. Tie-in of air barrier membrane with adjoining air barrier system.
7. Layout of walkway pads.

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D. Samples for Verification: Submit two samples 6 by 6 inches in size illustrating roof membrane.

E. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.

F. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, and supplementary instructions given.

G. Manufacturer's qualification statement.

H. Installer's qualification statement.

I. Warranty Documentation:

1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

2. Submit installer's written verification that installation complies with warranty conditions for waterproof membrane.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum twenty (20) years of documented experience.

B. Installer Qualifications: Company specializing in performing work of this section with at least ten (10) years of documented experience; approved, authorized, or licensed by by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1. Manufacturer training, approval, or license effective date must be prior to bidding.

2. Experience includes related work with thermoplastic membrane roofing, including, but not limited to, air barriers, roof insulation, flashing and counter-flashing, expansion joints, joint sealers, and other required components of single-ply membrane roofing systems.

C. Single-Source Responsibility for Roofing System: Provide components from a single source, from a single roofing membrane manufacturer, or components manufactured by others that have been approved by membrane manufacturer for use in the roof system and are covered by the single source roofing system warranty.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact, unless otherwise indicated.

1. Insulation shipping wrapping in not acceptable weather protection.

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.

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1.8 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather or when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

B. Do not apply roofing membrane when ambient temperature is below 20 degrees F or when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

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.

1.9 WARRANTY

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

B. Total Roofing System Warranty, No Dollar Limitation (NDL): Provide manufacturer's single-source "full system" warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes.

1. Warranty Term: 20 years.
2. For repair and replacement include costs of materials, labor, and installation in warranty.
3. Exceptions are not Permitted: Warranty includes the following:
    a. Damage due to accidental puncture.
    b. Damage due to roof traffic.
    c. Damage due to wind speed less than 90 miles per hour.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Thermoplastic Polyvinyl Chloride (PVC) Membrane Roofing Materials:

1. (Basis of Design) Sika Corporation Roofing; Sarnafil PVC: usa.sika.com/sarnafil.
2. Carlisle SynTec Systems: www.carlisle-syntec.com.
3. Duro-Last Roofing, Inc: www.duro-last.com.
4. Elevate: www.holcimelevate.com.
5. GAF: www.gaf.com.
6. Johns Manville: www.jm.com.
7. Siplast: www.siplast.com.

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8. Soprema, Inc: www.soprema.us.
9. Versico Roofing Systems: www.versico.com.

2.2 ROOFING

A. Thermoplastic Polyvinyl-Chloride (PVC) Membrane Roofing: One ply membrane, fully adhered fully adhered, over insulation

B. Roofing Assembly Requirements:

1. Components: System from top down to structural deck.
    a. Single-ply thermoplastic membrane.
    b. Insulation cover boards.
    c. Insulation.
    d. Air barrier.
    e. One of the following:
        1) Roof sheathing substrate boards on structural metal deck.
        2) Structural concrete deck.
2. Roof Covering External Fire Resistance Classification: UL (FRD) Class C, minimum.
3. Wind Resistance: Tested in accordance with FM 4474, UL 580, or UL 1897 to withstand wind uplift forces calculated in accordance with ASCE 7.
    a. Design Wind Speeds: As indicated on drawings.

2.3 MEMBRANE ROOFING AND ASSOCIATED MATERIALS

A. Membrane Roofing Materials:

1. PVC: Polyvinyl chloride (PVC) complying with ASTM D4434/D4434M, Type II or III, sheet contains reinforcing fibers or reinforcing fabrics.
    a. Thickness: 60 mil, 0.060 inch, minimum; 27 mil, 0.027 inch, minimum, above reinforcement, when tested in accordance with ASTM D7635/D7635M.
    b. Basis of Design:
        1) Sika; Sarnafil G 410-60.
2. Sheet Width: Manufacturer's standard.
    a. Adhered Application: Limit width to 120 inches, maximum, when ambient temperatures are less than 40 degrees F for extended period of time during installation.
3. Color: Gray.

B. Seaming Materials: As recommended by membrane manufacturer.

C. Air Barrier/Temporary Roof Membrane: Material approved by roof manufacturer; compatible with roofing and insulation materials.

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1. Membrane: ASTM D6164/D6164M Type I, Grade S; styrene-butadiene-styrene (SBS) polymer modified bitumen, reinforced with nonwoven polyester fabric; burn-off film on bottom surface and a sanded top surface. Provides temporary roof protection with up to six (6) months of exposure.
    a. Thickness: 118 mils (3.0 mm), nominal.
2. Complies with no fewer than one of the following:
    a. Air Permeance: 0.004 cfm/sq ft (0.02 L/s sq m) maximum membrane leakage when tested at 1.57 psf pressure difference in accordance with ASTM E2178.
    b. Water Vapor Permeance: 0.1 US perm (5.72 ng/(Pa·s·m2)) maximum, when tested in accordance with ASTM E96/E96M using Procedure B - Water Method.
3. Products:
    a. Sika Sarnafil Inc; Vapor Retarder TA 138.
    b. Soprema US; SOPRALENE 180 SP 3.0: www.soprema.us.

D. Flexible Flashing Material: Material recommended by membrane manufacturer.

E. Membrane-Surfaced Metal Sheet: Galvanized steel complying with ASTM A653/A653M, with G90/Z275 zinc coating and at least 24-gauge, 0.0239-inch thick base metal, and 20 mil, 0.020 inch thick thermoplastic coating laminated on one side; for use as perimeter edge, wall, or curb flashing.
1. Thermoplastic Coating: Compatible with roofing membrane, heat-weldable.
2. Color: Matching membrane.

2.4 DECK SHEATHING

A. Thermal Barrier Substrate Board: Glass-mat faced water-resistant gypsum panels complying with ASTM C1177/C1177M.
1. Thickness: 5/8 inch, Type X, fire-resistant.
2. Surface Finish: Factory primed.
3. Products:
    a. (Basis of Design) Georgia-Pacific; DensDeck Prime with EONIC Technology: www.densdeck.com.

2.5 COVER BOARDS

A. High-Density (HD) Polyiso: Faced, high compressive strength polyisocyanurate (ISO) insulation complying with ASTM C1289, and the following characteristics:
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 4 - faced with coated or uncoated glass-fiber-mat facers on both major surfaces of core foam

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2) Compressive Strength: Grade 1, 80 psi, minimum .

3) Thickness: 1/2 inch.

2. Board Thickness: 1/2 inch, maximum.

3. Thermal Resistance, R-value: 2.5, nominal, per 1/2 inch thickness.

4. Products:

a. (Basis of Design) Sika; Sarnatherm Roof Board A-III or H usa.sika.com/sarnafil.

2.6 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: Grade 2, 20 psi (138 kPa) minimum.

b. Thermal Resistance, R-value: R-5.6 (0.98) minimum at 1 inch thick, at 75 degrees F.

2. Board Thickness: Provide no fewer than two layers; thickness as required to achieve the minimum R-Value indicated on drawings.

3. Tapered Board: Slope as indicated; minimum thickness 1/2 inch; fabricate of fewest layers possible.

a. Roof Field: 1/4 inch per foot (1:48) slope.

b. Saddles and Crickets: 1/2 inch per foot (1:24) slope.

4. Board Edges: Square.

2.7 ACCESSORIES

A. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.

B. Nailers and Blocking: Wood; pressure preservative treated; see Section 06 10 53.

C. Deck Sheathing Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.

D. Membrane Adhesive: As recommended by membrane manufacturer.

E. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.

F. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.

G. Insulation Adhesive: As recommended by insulation manufacturer.

H. Termination Bars: Manufacturer's standard extruded aluminum bars, with integral sealant lip at top edge; prepunched, with noncorrosive fasteners.

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I. Sealants: As recommended by membrane manufacturer.

J. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.

1. Composition: Roofing membrane manufacturer's standard rubber with mineral granule surface or porous rubber with natural surface.

2. Size: Manufacturer's standard size; nominal size indicated on drawings.

3. Surface Color: As selected by Architect from manufacturer's standard range.

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.

3.2 PREPARATION - CONCRETE DECK

A. Fill surface honeycomb and variations with latex filler.

B. Do not begin work until elevated concrete substrate has cured at least 28 days and moisture content is five percent or less.

1. Test as Follows:

a. Concrete Moisture Content: No beading water under plastic after 16 hours when tested in accordance with ASTM D4263.

b. Relative Humidity in Concrete: Not greater than 75 percent when tested in accordance with ASTM F2170.

3.3 PREPARATION - METAL DECK

A. Install deck sheathing substrate board on metal deck:

1. Lay with long side at right angle to flutes; stagger end joints; provide support at ends.

2. Cut sheathing cleanly and accurately at roof breaks and protrusions to provide smooth surface.

3. Mechanically fasten sheathing to roof deck, in accordance with roofing manufacturer's instructions to withstand wind uplift forces.

a. Comply with FM DS 1-29 for uplift pressure at corners, perimeter, and field of roof.

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3.4 INSTALLATION, GENERAL

A. Start installation in presence of roofing membrane manufacturer's technical representative.

B. Perform work in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

C. Do not apply roofing membrane during cold or wet weather conditions.

D. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.

E. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

F. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

G. Coordinate this work with installation of associated counterflashings installed by other sections as the work of this section proceeds.

3.5 INSTALLATION - AIR BARRIER AND INSULATION, UNDER MEMBRANE

A. Install air barrier to deck surface with adhesive in accordance with manufacturer's instructions.

1. Prime concrete and gypsum sheathing deck surface.
2. Extend air barrier under blocking to deck edge.
3. Install flexible flashing from air barrier to air seal material of wall construction; lap and seal to provide continuity of the air-barrier plane.

B. Ensure air barrier is clean and dry, continuous, and ready for application of insulation.

C. Attachment of Insulation: Embed each layer of insulation in adhesive in full contact, in accordance with roofing and insulation manufacturers' instructions.

1. Comply with FM DS 1-29 for specified uplift pressure at corners, perimeter, and field of roof.

D. Cover Boards: Adhere cover board using insulation adhesive in accordance with roofing manufacturer's instructions.

1. Comply with FM DS 1-29 for specified uplift pressure at corners, perimeter, and field of roof.

E. Lay subsequent layers of insulation and cover board with joints staggered minimum 6 inches, in each direction, 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, and gap between boards no greater than 1/4 inch. Cut insulation to fit neatly to perimeter blocking, around penetrations through roof, and intersecting sloping roof decks.

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H. At roof drains, use factory-tapered boards to slope down to roof drains over a distance of 24 inches. Ensure cover board conforms to slope of drain sump and trim so that water flow is unrestricted.

I. Do not install more insulation and cover boards than can be completely waterproofed, covered with membrane, in same day.

3.6 INSTALLATION - MEMBRANE

A. Install membrane according to roofing membrane manufacturer's instructions.

B. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.

C. Shingle joints on sloped substrate in direction of drainage.

D. Fully Adhered Application: Apply adhesive to substrate as recommended 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.

E. Overlap edges and ends and seal seams by heat welding, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

F. At intersections with vertical surfaces:

1. Extend membrane up a minimum of eight (8) inches onto vertical surfaces.

2. Fully adhere flexible flashing over membrane and up to nailing strips or reglets. Secure to comply with one of the following methods.

a. Secure flashing to nailing strips at 4 inches on center.

b. Insert flashing into reglets and secure.

G. At gravel stops, extend membrane under gravel stop and to the outside face of the wall.

H. Around roof penetrations, seal flanges and flashings with flexible flashing.

I. Coordinate installation of roof drains and related flashings, locate field splices away from low areas and roof drains, and lap upslope sheet over downslope sheet.

3.7 INSTALLATION - FLEXIBLE WALKWAYS

A. Install walkway pads in compliance with manufacturer's instructions; heat weld or adhere to roofing membrane. Space pad joints to permit drainage.

B. Install walkways at the following locations:

1. Perimeter of each rooftop unit.

2. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.

3. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.

4. Top and bottom of each roof access ladder.

5. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.

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6. Locations indicated on Drawings.
7. As required by roof membrane manufacturer's warranty requirements.

3.8 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Owner will provide testing services, and Contractor to provide temporary construction and materials for testing in accordance with requirements.

C. Provide daily on-site attendance of roofing manufacturer's technical representative during installation of this work.

D. Manufacturer's Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.

E. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

3.9 CLEANING

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

B. Remove bituminous markings, if any, from finished surfaces.

C. Clean overspray and spillage from adjacent construction 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.

3.10 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

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SECTION 07 61 13 - STANDING SEAM SHEET METAL ROOFING AND WALL CLADDING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Standing Seam Roof Type R01 and R02; consisting of sheet metal roofing panels, secondary supports and anchors to structure, associated flashings, and underlayment.

B. Exterior Wall System Type X01; consisting of sheet metal siding panels, secondary supports, anchors to structure and associated flashings.

C. Gutters.

D. Downspouts.

E. Integral fascias.

F. Sealants for joints within sheet metal fabrications.

1.2 RELATED REQUIREMENTS

A. Refer to Section 01 23 00 - Alternates: Alternate No. A-1 for additional information.

B. Section 05 05 13 - Shop-Applied Coatings for Metal: Custom finish and color.

C. Section 06 10 00 - Rough Carpentry: Wood roof deck.

D. Section 07 21 00 - Thermal Insulation: Support for cladding and continuous insulation.

E. Section 07 72 00 - Roof Accessories: Manufactured snow guards.

1.3 REFERENCE STANDARDS

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

B. ASTM B69 - Standard Specification for Rolled Zinc; 2021.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

D. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2025.

E. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.4 ADMINISTRATIVE REQUIREMENTS

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

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on underlayment, metal types, and other characteristics.

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C. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

D. Installation Samples: Submit two samples 12 by 12 inches in size illustrating metal roofing mounted on plywood backing illustrating typical seam.

E. Color Samples: Comply with Section 05 05 13.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) requirements and standard details, except as otherwise noted.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five (5) years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

1.8 WARRANTY

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

B. Finish Warranty: Comply with Section 05 05 13.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Sheet Metal Roofing/Wall Cladding Manufacturers:

1. (Basis of Design) VMZINC PLUS Standing Seam Roofing, VMZINC Facades: www.vmzinc.com/en-us.
2. ATAS International, Inc; Field-Lok: atas.com.
3. DMI; Double-Lock DL20: dmimetals.com.
4. Construction Metal Products, Inc: www.cmpmetalsystems.com.
5. Petersen Aluminum Corporation: www.pac-clad.com.
6. Sheffield Metals International: www.sheffieldmetals.com.
7. Taylor Metal Products: www.taylormetal.com.
8. Substitutions: See Division 01 Sections for substitution procedures.

2.2 SHEET MATERIALS

A. Refer to Section 01 23 00 - Alternates for additional requirements for Alternate No. A-1.

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B. MTL-1 (if Alternate A-1 is accepted) Pre-Finished Aluminum Sheet: ASTM B209/B209M; 18-gauge, 0.040-inch minimum base metal thickness; plain texture; shop precoated with fluoropolymer coating complying with Section 05 05 13.

C. MTL-1 (Alternate A-1 Base Bid) Zinc Sheet: ASTM B69, 22 gauge, 0.032 inch (8mm) thick; with pre-patinated finish.

1. Color: VMZINC Pigmento Green.

2.3 FABRICATION

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

B. Fabricate cleats of same material as sheet, thickness to match roofing sheet, interlockable with sheet.

C. Fabricate starter strips, interlockable with sheet.

D. Form pieces in longest practical lengths.

E. Hem exposed edges on underside 1/2 inch; miter and seam corners.

2.4 FINISHES

A. Custom Finish and Color: Comply with Section 05 05 13.

2.5 ACCESSORIES

A. Fasteners: Stainless steel Same material and finish as roofing metal, with soft neoprene washers .

B. High Temperature Underlayment: Self-adhering butyl-rubber sheet complying with ASTM D1970/D1970M; strippable release film.

1. Top Sheet: Polyethylene film top surface.

2. Sheet Thickness: 40 mils, 0.04 inch, minimum.

3. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.

4. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.

5. Functional Temperature Range: Minus 45 degrees F to 300 degrees F.

C. Drainage/Airflow Membrane: Rigid structured underlay, 3/8 inch thick, manufactured from high density polyethylene; provides drainage and air flow directly under metal roof panels.

1. Basis of Design:

a. Delta VMZINC Membrane.

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

D. Concealed Sealants: Non-curing butyl sealant or butyl tape.

E. Exposed Sealants: ASTM C920 elastomeric sealant, with minimum movement capability as recommended by manufacturer for sealed substrates; color to match adjacent material.

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PART 3 EXECUTION

3.1 EXAMINATION

A. Inspect roof deck to verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to eaves.

B. Verify deck is dry and free of snow or ice.

C. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, reglets are in place, and nailing strips located.

D. 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 and surfaces in contact with dissimilar metals with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

C. Place eave edge metal flashings tight with fascia boards. Weather lap joints 2 inches and seal with roof cement. Secure flange with nails.

3.3 INSTALLATION

A. Roofing:

1. Apply underlayment over entire roof area, as follows:
    a. Apply in single layer, laid perpendicular to slope; weather lap edges 2 inches and nail in place.
2. Apply drainage/airflow membrane over underlayment, mechanically fasten.
3. Cleat and seam sheet metal roofing joints.
4. Use butyl tape to seal concealed joints between metal roofing surfaces.
5. Provide gutters, downspouts, and fascias.

B. Standing Seam Roofing/Wall Cladding:

1. Comply with SMACNA (ASMM) details.
2. Space standing seams at spacing indicated on drawings.
3. Lay sheets with long dimension perpendicular to eaves. Apply pans beginning at eaves.
4. Lock cleats into seams and flatten.
5. Stagger transverse joints of metal sheets.
6. At eaves and gable ends, terminate roofing by hooking over edge strip.
7. Finish standing seams 2 inch high on flat surfaces
8. Bend up one side edge 1-1/2 inches and other edge 1-3/4 inches.
9. Make first fold 1/4-inch wide single fold and second fold 1/2 inch wide, providing locked portion of standing seam, five plies in thickness.

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10. Fold lower ends of seams at eaves over at 45 degree angle.

C. Gutters and Downspouts:

1. Comply with SMACNA (ASMM) details.
2. Secure gutter lining to substrate with cleats spaced minimum 32 inches on center along edges of gutters.
3. Longitudinal joints not acceptable.
4. At roof edges, extend gutter lining under metal roofing at least 6 inches, and terminate in 3/4-inch folded edge secured by cleats. Hook lower end of roofing into lock strip to form 3/4-inch wide loose-lock seam.
5. Seal gutters watertight, and seal joint of gutter to drain.
6. Connect downspouts to downspout boots above grade, and seal connection watertight.

D. Flashing:

1. Comply with SMACNA (ASMM) details.
2. Insert flashings into reglets to form tight fit.
   a. Secure in place with lead wedges, and pack remaining spaces with lead wool.
   b. Seal flashings into reglets with sealant.
3. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.
4. Cleat and seam each joint.
5. Apply roof cement compound between metal flashings and felt flashings.
6. Fit flashings tight in place, and make corners square, surfaces true and straight in planes, and lines accurate to profiles.
7. Seal metal joints watertight.

3.4 PROTECTION

A. Do not permit traffic over unprotected roof surface.

END OF SECTION

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SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings and counterflashings.

B. Sealants for joints within sheet metal fabrications.

1.2 RELATED REQUIREMENTS

A. Section 05 05 13 - Shop-Applied Coatings for Metal: Custom finish and color.

B. Section 07 54 00 - Thermoplastic Membrane Roofing: Membrane-coated sheet metal for field-of-roof flashing.

C. Section 07 61 13 - Standing Seam Sheet Metal Roofing and Wall Cladding: Gutters and downspouts.

D. Section 07 71 00 - Roof Specialties: Prefabricated roof edge metal, including gravel stops, copings, and fascias.

E. Section 07 72 00 - Roof Accessories: Manufactured snow guards.

1.3 REFERENCE STANDARDS

A. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

B. ASTM B69 - Standard Specification for Rolled Zinc; 2021.

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 D4479/D4479M - Standard Specification for Asphalt Roof Coatings - Asbestos-Free; 2007 (Reapproved 2024).

F. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.4 ADMINISTRATIVE REQUIREMENTS

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

1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.

3. Review requirements for insurance and certificates if applicable.

4. Review sheet metal flashing observation and repair procedures after flashing installation.

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1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
9. Include details of special conditions.
10. Include details of connections to adjoining work.
11. Detail formed flashing and trim at scale of not less than 3 inches per 12 inches.

C. Color Samples: Comply with Section 05 05 13.

1.6 QUALITY ASSURANCE

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

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with not less than five (5) years of documented experience. 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.

1.7 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.

1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
2. Protect stored sheet metal flashing and trim from contact with water.

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1.8 WARRANTY

A. See Division 01 Sections for additional warranty requirements.

B. Finish Warranty: Comply with Section 05 05 13.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim are not to rattle, leak, or loosen, and are to remain watertight.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

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

2.2 SHEET MATERIALS

A. Stainless Steel: ASTM A666/A666M, Type 304 alloy, soft temper, 28 gauge, 0.0156 inch thick; smooth as fabricated, mill finish.

B. (MTL-1 Base Bid) Zinc Sheet: ASTM B69, 22 gauge, 0.032 inch (8mm) thick; finish and color complying with Section 07 61 13.

2.3 PREFINISHED ALUMINUM SHEETS

A. Description: Factory-applied topcoat systems applied to aluminum flat sheet substrates prior to fabrication by coil coating; topcoat systems consist of primers and organic topcoats on exposed side and backing coats on unexposed side.

B. Protect finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

C. Aluminum Sheet Substrates: ASTM B209/B209M, alloy and temper as recommended by manufacturer for application.

D. (MTL-1 alternate, MTL-2, MTL-3) Finish and Color: Comply with Section 05 05 13.

2.4 FABRICATION

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in referenced sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.

1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

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2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
5. Do not use exposed fasteners on faces exposed to view.

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

C. Fabricate cleats of same material as sheet, minimum 6 inches wide, 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. Fabricate corners from one piece with minimum 18-inch long legs; seam for rigidity, seal with sealant.

H. Do not use graphite pencils to mark metal surfaces.

I. Fabrication Tolerances:

1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

2.5 ACCESSORIES

A. Fasteners: Stainless steel or same material and finish as metal sheet, with soft neoprene washers.

B. Protective Backing Paint: Asphaltic mastic, ASTM D4479 Type I.

C. Sealants:

1. See Section 07 92 00 - Joint Sealants for additional requirements.
2. Concealed Sealants: Non-curing butyl sealant.
3. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

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PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

C. Verify roofing termination and base flashings are in place, sealed, and secure.

D. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

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 INSTALLATION

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of referenced sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

B. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

C. Comply with drawing details.

D. Secure flashings in place using concealed fasteners; use exposed fasteners only where permitted and explicitly approved in writing on shop drawings by Architect.

E. Apply plastic cement compound between metal flashings and felt flashings.

F. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

G. Seal metal joints watertight.

3.4 TOLERANCES

A. Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8 inch offset of adjoining faces and of alignment of matching profiles.

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3.5 CLEANING

A. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.

B. Clean off excess sealants.

3.6 PROTECTION

A. Protect installed sheet metal flashings and trim from subsequent construction operations.

B. Maintain sheet metal flashing and trim in clean condition during construction.

C. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION

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SECTION 07 71 00 - ROOF SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Manufactured roof specialties, including copings and gravel stops.

1.2 RELATED REQUIREMENTS

A. Section 05 05 13 - Shop-Applied Coatings for Metal: Custom finish and color.

1.3 REFERENCE STANDARDS

A. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems; 2022.

B. NRCA (RM) - The NRCA Roofing Manual; 2025.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.

C. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.

D. Finish Color Samples: Comply with Section 05 05 13.

E. Samples: Submit two appropriately sized samples of coping and gravel stop.

1.5 WARRANTY

A. See Section Division 01 Sections for additional warranty requirements.

B. Finish Warranty: Comply with Section 05 05 13.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Roof Edge Flashings and Copings:

1. ATAS International, Inc: www.atas.com.
2. Hickman Edge Systems: www.hickmanedgesystems.com.
3. Metal-Era Inc: www.metalera.com.
4. Substitutions: See Section 01 60 00 - Product Requirements.

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2.2 COMPONENTS

A. Roof Edge Flashings: Factory fabricated to sizes required; corners mitered; concealed fasteners.

1. Configuration: Fascia, 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. Exposed Face Height: As indicated on drawings.
4. Material: Formed aluminum sheet, 0.050 inch thick, minimum.

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. Outside Face Height: As indicated on drawings.
5. Inside Face Height: As indicated on drawings.
6. Material: Formed aluminum sheet, 0.040 inch thick, minimum.

2.3 FINISHES

A. (MTL-1, MTL-2, MTL-3) Finish and Color: Comply with Section 05 05 13.

PART 3 EXECUTION

3.1 INSTALLATION

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

END OF SECTION

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SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roof curbs.

B. Snow guards.

C. Roof snow and ice melting system.

1.2 RELATED REQUIREMENTS

A. Section 05 05 13 - Shop-Applied Coatings for Metal: Custom finish and color.

1.3 REFERENCE STANDARDS

A. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2025a.

1.4 SUBMITTALS

A. See Division 01 Sections for submittal procedures.

B. 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.

C. 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.

D. Samples: Comply with Section 05 05 13.

E. Warranty Documentation:

1. Submit manufacturer warranty.
2. Ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 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.

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1.6 WARRANTY

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

B. Finish Warranty: Comply with Section 05 05 13.

PART 2 PRODUCTS

2.1 ROOF CURBS

A. Roof Curbs Mounting Assemblies: Factory fabricated hollow sheet metal construction, internally reinforced, and capable of supporting superimposed live and dead loads and designated equipment load with fully mitered and sealed corner joints welded or mechanically fastened, and integral counterflashing with top and edges formed to shed water.

1. Applications: Roof curbs used for roof penetrations/openings as indicated on drawings.
2. Roof Curb Mounting Substrate: Curb substrate consists of flat roof deck.
3. Sheet Metal Material:
    a. Galvalume Steel: Hot-dip aluminum zinc alloy coated steel sheet complying with ASTM A792/A792M; AZ55 coating designation; 18 gauge, 0.048 inch thick.

B. Curbs Adjacent to Roof Openings: Provide curb on each side of opening, with top of curb horizontal for equipment mounting.

1. Provide preservative treated wood nailers along top of curb.
2. Insulate inside curbs with 1-1/2 inch thick fiberglass insulation.
3. Height Above Roof Deck: 14 inches, minimum.

2.2 SNOW GUARDS

A. Fence Type Snow Guard: Continuous snow guard; manufacturer's standard dual pipe, bar, channel, or solid rod, set in brackets or posts, with optional plates and metal trim to match roof.

1. Brackets: Match roof material.
2. Pipe or Square Tube: Finish and color to match roof.
3. (MTL-1) Finish and Color: Comply with Section 05 05 13.
4. Products:
    a. (Basis of Design) Alpine SnowGuards; ASG4025-AL Standing Seam Two-Pipe Snow Guard: www.alpinesnowguards.com.
    b. Berger Building Products: www.bergerbp.com.
    c. Construction Metal Products, Inc: www.aceclamp.com.
    d. LMCurbs: www.lmcurbs.com.
    e. Metal Roof Innovations, Ltd. S-5! Attachment Solutions: www.s-5.com.
    f. PMC Industries, Inc: www.aceclamp.com.

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g. Rocky Mountain Snow Guards, Inc: www.rockymountainsnowguards.com.

h. TRA Snow and Sun: www.trasnowandsun.com.

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

2.3 ROOF SNOW AND ICE MELTING SYSTEMS

A. Roof Snow and Ice Melting Systems: Self-regulating heating cable system for roof and gutter applications to melt snow and ice.

1. Application: Standing seam metal roofing system with gutter.

2. Provide cable spacing and number of heating circuits and accessories in accordance with manufacturer's written requirements.

3. Cable: Nickel-plated copper bus wires with radiation cross-linked polyolefin heating core and primary dielectric insulation, copper metallic braid, and polyolefin outer cover.

4. Cable Bend Radius: 1-1/4 inch, minimum.

5. Supply Voltage: 110-120 VAC with ground-fault protection as required by authorities having jurisdiction (AHJ).

6. Power Output: 12 W/linear ft, nominal, of cable length in snow and ice at 32 degrees F.

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.

3.4 CLEANING

A. Clean installed work to like-new condition.

3.5 PROTECTION

A. Protect installed products until completion of project.

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

END OF SECTION

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SECTION 07 92 00 - JOINT SEALANTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Joint sealant applications and joint sealant schedule.

B. Nonsag gunnable joint sealants.

C. Self-leveling pourable joint sealants, including flexible low-expanding spray-foam.

D. Joint backings and accessories.

E. Owner-provided field quality control.

1.2 RELATED REQUIREMENTS

A. Section 07 21 19 - Foamed-In-Place Insulation: Rigid spray-applied foam for general insulation applications.

B. Section 07 27 23 - Gypsum Sheathing Air Barriers: Sealants required in conjunction with air barriers.

C. Section 08 44 13 - Glazed Aluminum Curtain Walls: Structural silicone glazing sealants.

D. Section 08 71 00 - Door Hardware: Setting exterior door thresholds in sealant.

E. Section 08 80 00 - Glazing: Glazing sealants and accessories.

F. Section 09 21 16 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

G. Section 09 30 00 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

1.3 DEFINITIONS

A. Interior Wet Areas: Include restrooms, kitchenettes, and janitor's closets; fixtures in wet areas include plumbing fixtures and countertops.

B. Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".

1.4 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015 (Reapproved 2022).

B. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).

C. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

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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 C1248 - Standard Test Method for Staining of Porous Substrate by Joint 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).

J. ASTM D1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics; 2020.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

L. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:

1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.

2. List of backing materials approved for use with the specific product.

3. Backing material recommended by sealant manufacturer.

4. Substrates that product is known to satisfactorily adhere to and with which it is compatible.

5. Substrates the product should not be used on.

6. Substrates for which use of primer is required.

7. Installation instructions, including precautions, limitations, and recommended backing materials and tools.

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. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.

2. Joint-sealant manufacturer and product name.

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3. Joint-sealant formulation.
4. Joint-sealant color.

G. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

H. Installation Plan: Submit at least four weeks prior to start of installation.

I. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.

J. Field Quality Control Plan: Submit at least two weeks prior to start of installation.

K. 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.

L. Installation Log: Submit filled-out log for each length or instance of sealant installed.

M. 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.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section and with at least five (5) ___ years of documented experience.

B. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.

1. Adhesion Testing: In accordance with ASTM C794.
2. Compatibility Testing: In accordance with ASTM C1087.
3. Allow sufficient time for testing to avoid delaying the work.
4. Deliver sufficient samples to manufacturer for testing.
5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
6. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.

C. Installation Plan: Include schedule of sealed joints, including the following:

1. Joint width indicated in Contract Documents.
2. Joint depth indicated in Contract Documents; to face of backing material at centerline of joint.
3. Method to be used to protect adjacent surfaces from sealant droppings and smears, with acknowledgment that some surfaces cannot be cleaned to like-new condition and therefore prevention is imperative.
4. Approximate date of installation, for evaluation of thermal movement influence.

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5. Installation Log Form: Include the following data fields, with known information filled out.
    a. Unique identification of each length or instance of sealant installed.
    b. Location on project.
    c. Substrates.
    d. Sealant used.
    e. Stated movement capability of sealant.
    f. Primer to be used, or indicate no primer is used.
    g. Size and actual backing material used.
    h. Date of installation.
    i. Name of installer.
    j. Actual joint width; provide space to indicate maximum and minimum width.
    k. Actual joint depth to face of backing material at centerline of joint.
    l. Air temperature.

D. 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. Name(s) of sealant manufacturer's field representatives who will be observing.
3. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
    a. Substrate; if more than one type of substrate is involved in a single joint, provide two entries on form, for testing each sealant substrate side separately.
    b. Test date.
    c. Location on project.
    d. Sealant used.
    e. Stated movement capability of sealant.
    f. Test method used.
    g. Date of installation of field sample to be tested.
    h. Date of test.
    i. Copy of test method documents.
    j. Age of sealant upon date of testing.
    k. Test results, modeled after the sample form in the test method document.
    l. Indicate use of photographic record of test.

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E. Owner will employ an independent testing agency to perform the field quality control inspection and testing as referenced in PART 3 of this section and as follows, to prepare and submit the field quality control plan and log, and to provide recommendations of remedies in the case of failure.

1. Contractor shall cooperate with testing agency and repair failures discovered and destructive test location damage.

F. Field Quality Control Plan:

1. Visual inspection of entire length of sealant joints.
2. Nondestructive field adhesion testing of sealant joints, except interior acrylic latex sealants.
    a. For each different sealant and substrate combination, allow for one test every 12 inches in the first 10 linear feet of joint and one test every 24 inches thereafter.
    b. If any failures occur in the first 10 linear feet, continue testing at 12 inches intervals at no extra cost to Owner.
3. 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.
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.

G. 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. Take photographs or make video records of each test, with joint identification provided in the photos/videos; for example, provide small erasable whiteboard positioned next to joint.
4. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
5. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
6. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.
7. 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.

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H. Nondestructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Nondestructive Spot Method.

1. Record results on Field Quality Control Log.
2. Repair failed portions of joints.

I. 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.
4. Record results on Field Quality Control Log.
5. Repair failed portions of joints.

J. Field Adhesion Tests of Joints: Test for adhesion using most appropriate method in accordance with ASTM C1521, or another applicable method as recommended by manufacturer.

PART 2 PRODUCTS

2.1 JOINT SEALANT SCHEDULE

A. Exterior Joints: Use nonsag nonstaining silicone sealant, unless otherwise indicated.

1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, noncuring.
2. Lap Joints between Manufactured Metal Panels: Butyl rubber, noncuring.
3. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane traffic-grade sealant.
4. Concealed Shim Spaces at Rough Openings: Flexible low-expanding spray-foam.

B. Interior Joints: Use nonsag polyurethane sealant, unless otherwise indicated.

1. Wall and Ceiling Joints in Nonwet Areas (Not Interior Joints at Exterior Walls): Acrylic emulsion latex sealant.
2. Joints between Plumbing Fixtures and Floors and Walls: Mildew-resistant silicone sanitary sealant; white.
3. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
4. Control Joints in Interior Sealed Concrete Floors: Self-leveling polyurea sealant.
5. Other Floor Joints: Self-leveling polyurethane traffic-grade sealant.

C. See Part 1 DEFINITIONS article for information.

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1. Interior Wet Areas
2. Sound-Rated Assemblies

2.2 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

B. Colors: Match adjacent finished surfaces, as selected by Architect from manufacturer's full range.

2.3 NONSAG JOINT SEALANTS

A. Nonstaining Silicone Sealant: ASTM C920, Grade NS, Uses M, A, G, and O; not expected to withstand continuous water immersion or traffic.

1. Movement Capability: Plus and minus 50 percent, minimum.
2. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.
3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
4. Color: Match adjacent finished surfaces; to be selected by Architect from manufacturer's custom range.
5. Cure Type: Single-component, neutral moisture curing.
6. Products:
    a. Dow; DOWSIL 756 SMS Building Sealant: www.dow.com.
    b. Momentive Performance Materials, Inc; SCS9000 SilPruf NB - Non-Staining Silicone Weatherproofing Sealant: siliconeforbuilding.com.
    c. Pecora Corporation; Pecora 864 NST (Non-Staining Technology): www.pecora.com.
    d. Sika Corporation; Sikasil WS-290: usa.sika.com.
    e. Tremco Commercial Sealants; Spectrem 3: www.tremcosealants.com.

B. Mildew-Resistant Silicone Sanitary Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand traffic or continuous water immersion.

1. Color: To be selected by Architect from manufacturer's full range.
2. Products:
    a. Dow; DOWSIL 786: www.dow.com.
    b. Momentive Performance Materials, Inc; SCS1700 Sanitary: siliconeforbuilding.com.
    c. Pecora Corporation; Pecora 898 NST (Non-Staining Technology): www.pecora.com.
    d. Sika Corporation; Sikasil GP: www.usa.sika.com.
    e. Tremco Commercial Sealants; Tremsil 200: www.tremcosealants.com.

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C. Polyurethane Sealant: ASTM C920, Grade NS, Uses NT, T, M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.

1. Movement Capability: Plus and minus 50 percent, minimum.
2. Color: Match adjacent finished surfaces.
3. Products:
    a. Pecora Corporation; DynaTrol II: www.pecora.com.
    b. Sika Corporation; Sikaflex-2c NS: www.usa.sika.com.
    c. Tremco Commercial Sealants; Dymonic 100: www.tremcosealants.com.

D. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, nonsagging; not intended for exterior use.

1. Color: Standard colors matching finished surfaces, Type OP (opaque).
2. Grade: ASTM C834; Grade 0 Degrees F (Minus 18 Degrees C).
3. Products:
    a. Everkem Diversified Products, Inc; SilTex 40: www.everkemproducts.com.
    b. Hilti, Inc; CP 506 Smoke and Acoustical Sealant: www.us.hilti.com.
    c. Pecora Corporation; AC-20 +Silicone: www.pecora.com.
    d. Sherwin-Williams; 950A Siliconized Acrylic Latex Caulk: www.sherwin-williams.com.
    e. Specified Technologies Inc; Smoke N' Sound Acoustical Sealant: www.stifirestop.com.
    f. Tremco Commercial Sealants; Tremflex 834: www.tremcosealants.com.

E. Noncuring Butyl Sealant: Solvent-based, single component, nonsag, nonskinning, nonhardening, nonbleeding; non-vapor permeable; intended for fully concealed applications.

1. Products:
    a. Pecora Corporation; Pecora BA-98 Non-Skinning Butyl Sealant: www.pecora.com.
    b. Premier Building Solutions; XtraBond 1500NS: www.premierbuildingsolutions.net.
    c. Tremco Commercial Sealants; Acoustical/Curtainwall Sealant: www.tremcosealants.com.

2.4 SELF-LEVELING JOINT SEALANTS

A. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion.

1. Movement Capability: Plus and minus 25 percent, minimum.
2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
3. Color: Color as selected.
4. Products:

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a. Pecora Corporation; Urexpan NR-201 or DynaTrol II-SL: www.pecora.com.

b. Sika Corporation; Sikaflex-1c SL or Sikaflex-2c SL: www.usa.sika.com.

c. Tremco Commercial Sealants; Vulkem 45SSL: www.tremcosealants.com.

B. Flexible Polyurethane Spray-Foam: Single component, gun grade, and low-expanding; intended for filling concealed shim spaces between frames and rough openings in the building enclosure, to maintain continuity in the thermal envelope and minimize air infiltration.

1. Surface Burning Characteristics: Flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.

2. Density: 1.75 lbs/cu ft, maximum, in accordance with ASTM D1622.

3. Products:

a. Adfast USA Inc; Adfoam Flex 1865: www.adfastcorp.com.

b. DAP Products Inc; DRAFTSTOP 812 Foam: www.dapspecline.com.

c. DuPont de Nemours, Inc; Froth-Pak Foam Sealant: www.frothpak.dupont.com.

d. Premier Building Solutions; XtraFoam Minimal Expanding Foam Sealant: www.premierbuildingsolutions.net.

e. Tremco Commercial Sealants; ExoAir LEF: www.tremcosealants.com.

C. Semi-Rigid Self-Leveling Polyurea Joint Filler: Two-component, 100 percent solids; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.

1. Durometer Hardness, Type A: 75, minimum, after seven days when tested in accordance with ASTM D2240.

2. Color: To be selected by Architect from manufacturer's standard colors.

3. Joint Width, Minimum: 1/8 inch.

4. Joint Width, Maximum: 3/4 inch.

5. Joint Depth: Provide product suitable for joints from 1/8 inch to 2 inches in depth excluding space for backer rod.

6. Products:

a. ARDEX Engineered Cements; ARDEX ARDISEAL RAPID PLUS: www.ardexamericas.com.

b. Euclid Chemical Company; EUCO QWIKjoint UVR: www.euclidchemical.com.

c. Mapei; Mapeiflex Joint Filler PO 95/100: www.mapei.com.

d. Nox-Crete Inc; DynaFlex JF-85: www.nox-crete.com.

e. Sika Corporation; Sika Loadflex 524 EZ: www.usa.sika.com.

f. SpecChem, LLC; Rapid Flex CJ: www.specchemllc.com.

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2.5 ACCESSORIES

A. Sealant Backing Materials, General: Materials placed in joint before applying sealants; assists sealant performance and service life by developing optimum sealant profile and preventing three-sided adhesion; type and size recommended by sealant manufacturer for compatibility with sealant, substrate, and application.

B. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

C. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.

D. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.1 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. Arrange for sealant manufacturer's technical representative to be present during tests.
4. Record each test on Preinstallation Adhesion Test Log as indicated.
5. 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.
6. 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.

E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in an inconspicuous area to verify that it does not stain or discolor slab.

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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. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

D. Install bond breaker backing tape where backer rod cannot be used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

H. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

3.4 FIELD QUALITY CONTROL

A. See Division 01 Sections for additional requirements.

B. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.

C. Non-Destructive Adhesion Testing: If there are any failures in first 100 linear feet, notify Architect immediately.

D. Destructive Adhesion Testing: If there are any failures in first 1,000 linear feet, notify Architect immediately.

E. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

F. Repair destructive test location damage immediately after evaluation and recording of results.

END OF SECTION

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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.

1.2 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware.

B. Section 09 91 23 - Interior Painting: Field painting.

1.3 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 A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2024.

D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.

E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2025.

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

G. 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.

H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2025.

I. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.

J. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

K. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

L. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2024.

M. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2024.

N. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.

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O. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2023.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods.

C. Shop Drawings: Details of each opening, showing elevations, glazing, and frame profiles.

1.5 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.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Hollow Metal Doors and Frames:

1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com.
2. Curries, an Assa Abloy Group company: www.assaabloydss.com.
3. Mesker, dormakaba Group: www.meskeropeningsgroup.com.
4. Republic Doors, an Allegion brand: www.republicdoor.com.
5. Steelcraft, an Allegion brand: www.allegion.com.
6. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:

1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
2. Accessibility: Comply with ICC A117.1 and ADA Standards.
3. Door Edge Profile: Manufacturers standard for application indicated.
4. Typical Door Face Sheets: Flush. Refer to Door Schedule for additional information.
5. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

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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.

2.3 HOLLOW METAL DOORS

A. Door Finish: Factory primed and field finished.

B. Interior Doors, Non-Fire-Rated:

1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).

a. Level 3 - Extra Heavy-duty.

b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.

c. Model 1 - Full Flush.

d. Door Face Metal Thickness: 16 gauge, 0.053 inch, minimum.

2. Door Thickness: 1-3/4 inches, nominal.

2.4 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Frame Finish: Factory primed and field finished.

C. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.

1. Frame Metal Thickness: 14 gauge, 0.067 inch, minimum.

D. Frames for Wood Doors:

1. Frame Metal Thickness: 14 gauge, 0.067 inch, minimum.

2.5 FINISHES

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

2.6 ACCESSORIES

A. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.

B. 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.

C. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

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B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.2 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. Coordinate frame anchor placement with wall construction.

C. Install door hardware as specified in Section 08 71 00.

1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.

D. Coordinate installation of electrical connections to electrical hardware items.

3.3 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

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

3.4 ADJUSTING

A. Adjust for smooth and balanced door movement.

END OF SECTION

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SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flush wood doors.

1.2 RELATED REQUIREMENTS

A. Section 08 11 13 - Hollow Metal Doors and Frames.

B. Section 08 71 00 - Door Hardware.

1.3 REFERENCE STANDARDS

A. 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, and other details.

D. Samples: Submit two samples of door veneer, illustrating wood grain, stain color, and sheen.

E. Specimen warranty.

F. Warranty, executed in Owner's name.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than ten (10) 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 if stored more than one week, and break seal on site to permit ventilation.

1.7 WARRANTY

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

B. Manufacturer Warranty: Provide manufacturer's warranty on interior doors for the life of the installation. Complete forms in Owner's name and register with manufacturer.

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1. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Wood Veneer Faced Doors:

1. Haley Brothers: www.haleybros.com.
2. Krieger Specialty Products: www.kriegerproducts.com.
3. Masonite Architectural: www.architectural.masonite.com.
4. Oregon Door: www.oregondoor.com.
5. VT Industries, Inc: www.vtindustries.com.
6. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 DOORS

A. Doors: See drawings for locations and additional requirements.

1. Quality Standard: Custom Grade, Extra Heavy Duty performance, in accordance with WDMA I.S. 1A.
2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.

1. Provide solid core doors at each location.
2. Wood veneer facing with factory transparent finish.

2.3 DOOR AND PANEL CORES

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

2.4 DOOR FACINGS

A. Veneer Facing for Transparent Finish: White oak, HPVA Grade A, ___, with slip match between leaves of veneer, balance match of spliced veneer leaves assembled on door or panel face.

1. Vertical Edges: Same species as face veneer.

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.

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C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

E. 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-6, Catalyzed Polyurethane.

b. Stain: As selected by Architect from manufacturer's standard range.

c. Sheen: Satin.

B. Factory finish doors in accordance with sample to be provided.

C. Seal door top edge with color sealer to match door facing.

2.7 ACCESSORIES

A. Hollow Metal Door Frames: See Section 08 11 13.

B. Door Hardware: See Section 08 71 00.

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.

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.

3.3 TOLERANCES

A. Comply with specified quality standard for fit and clearance tolerances.

B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.4 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

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B. Adjust closers for full closure.

END OF SECTION

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SECTION 08 16 13 - FIBERGLASS REINFORCED PLASTIC (FRP) DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fiberglass doors.

B. Fiberglass door frames.

1.2 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware.

1.3 REFERENCE STANDARDS

A. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2024.

C. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

E. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

F. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights; 2023.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Obtain hardware templates from hardware manufacturer prior to starting fabrication.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard details, installation instructions, hardware and anchor recommendations.

C. Shop Drawings: Indicate layout and profiles; include assembly methods.

1. Indicate product components, including hardware reinforcement locations and preparations, accessories, finish colors, patterns, and textures.

2. Indicate wall conditions, door and frame elevations, sections, materials, gauges, finishes, location of door hardware by dimension, and details of openings; use same reference numbers indicated on drawings to identify details and openings.

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D. Selection Samples: Submit two complete sets of color chips, illustrating manufacturer's available finishes, colors, and textures.

E. Test Reports: Submit certified test reports from qualified independent testing agency indicating doors comply with specified performance requirements.

F. Manufacturer's qualification statement.

G. Maintenance Data: Include instructions for repair of minor scratches and damage.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than ten (10) years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

B. Store materials in original packaging, under cover, protected from exposure to harmful weather conditions and from direct contact with water.

1. Store at temperature and humidity conditions recommended by manufacturer.
2. Do not use non-vented plastic or canvas shelters.
3. Immediately remove wet wrappers.

C. Store in position recommended by manufacturer, elevated minimum 4 inches above grade, with minimum 1/4 inch space between doors.

1.8 FIELD CONDITIONS

A. Do not install doors until structure is enclosed.

1.9 WARRANTY

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

B. Provide five (5) year manufacturer warranty covering materials and workmanship or exposure to weather.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Fiberglass Doors and Frames:

1. ChemPruf Door Company, Ltd: www.chem-pruf.com.
2. CORRIM Company: corrim.com.
3. Special-Lite, Inc: www.special-lite.com.
4. Tiger Door, LLC: www.tigerdoor.com.
5. Substitutions: See Division 01 Sections for substitution procedures.

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2.2 DOOR AND FRAME ASSEMBLIES

A. Door and Frame Assemblies: Factory-fabricated, prepared and machined for hardware.

1. Operation: Manual.
2. Physical Endurance: Swinging door cycle test to ANSI/SDI A250.4, Level A (1,000,000 cycles) minimum; tested with hardware and fasteners intended for use on project.
3. Screw-Holding Capacity: Tested to 890 pounds, minimum.
4. Surface Burning Characteristics: Flame spread index (FSI) of 26 to 75, Class B, and smoke developed index (SDI) of 450 or less, when tested in accordance with ASTM E84.
5. Flammability: Self-extinguishing when tested in accordance with ASTM D635.
6. Sizes: As indicated on drawings.
7. Clearance Between Door and Frame: 1/8 inch, maximum.
8. Clearance Between Bottom of Door and Finished Floor: 3/4 inch, maximum; not less than 1/4 inch clearance to threshold.
9. Provide frame anchors that allow for variation in rough opening size; field cutting of doors or frames to fit is not permitted.

2.3 COMPONENTS

A. Doors: Fiberglass construction with reinforced core.

1. Type: As indicated on drawings, including swinging doors.
2. Thickness: 1-3/4 inch, nominal.
3. Core Material: Urethane foam.
4. Construction: Manufacturer's standard complying with one of the following:
    a. Pultruded as single monolithic fiberglass reinforced plastic (FRP) panel.
    b. Molded in one piece including through color gel coating on each side; manufacturer's standard subframe, core and faces fused during curing; hardware reinforcements.
    c. Fiberglass faces laminated to core with an applied gel coating, or molded in one piece including gel coating on each side.
5. Face Sheet Texture: Smooth.
6. Door Panel Configuration: Flush door.
7. Subframe and Reinforcements: Manufacturer's standard materials.
8. Waterproof Integrity: Provide factory fabricated edges, cut-outs, and hardware preparations of fiberglass reinforced plastic (FRP); provide cut-outs with joints sealed independently of glazing, louver inserts, or trim.

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9. Hardware Preparations: Factory reinforce, machine, and prepare for door hardware including field installed items; provide solid blocking for each item; field cutting, drilling or tapping is not permitted; obtain manufacturer's hardware templates for preparation as necessary.

B. Door Frames: Provide type in compliance with performance requirements specified for doors.

1. Type: Knock-down type for field assembly.
2. Profiles: As indicated on drawings.
3. Construction: One of the following types:
   a. Fiberglass reinforced plastic (FRP) with gel-coating matching doors.
   b. Fiberglass pultrusions with gel-coating matching doors.
4. Corner Joints: Mitered with concealed corner blocks or angles of same material as frame; fiberglass and aluminum joined with screws; steel and stainless steel spot welded; sealed watertight with silicone sealant; field assemble knock-down type frames as required.
5. Hardware Cut-outs: Provide continuous backing or mortar guards of same material as frame, with watertight seal.
6. Frame Anchors: Stainless steel, Type 304; provide three anchors in each jamb for heights up to 84 inches with one additional anchor for each additional 24 inches in height.
7. Reinforcing: Provide manufacturer's standard reinforcing at hinge, strike, and closer locations.

2.4 PERFORMANCE REQUIREMENTS

A. Provide door assemblies that have been designed and fabricated in compliance with specified performance requirements.

B. Water Leakage: No uncontrolled leakage on interior face when tested in accordance with ASTM E331 at differential pressure of 7.5 psf.

C. Thermal Transmittance, Exterior Doors: AAMA 1503, U-value of 0.18, maximum, measured on exterior door in size required for this project.

2.5 FINISHES

A. Gel Coating: Ultraviolet (UV) stabilized polyester finish.

1. Thickness: Minimum 15 mils, 0.015 inch wet thickness, plus/minus 3 mils, 0.003 inch.
2. Color: As selected by Architect from manufacturer's full line of colors.

2.6 HARDWARE

A. Door Hardware: See Section 08 71 00.

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PART 3 EXECUTION

3.1 EXAMINATION

A. Verify actual dimensions of openings by field measurements before door fabrication; show recorded measurements on shop drawings.

B. Do not begin installation until substrates have been properly prepared.

3.2 PREPARATION

A. Remove existing doors and frames, and dispose of all removed materials in accordance with local authorities having jurisdiction.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Clean and prepare substrate in accordance with manufacturer's directions.

D. Protect adjacent work and finish surfaces from damage during installation.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions; do not penetrate frames with anchors.

B. Install exterior doors in accordance with ASTM E2112.

C. Install door hardware as specified in Section 08 71 00.

D. Set units plumb, level, and true-to-line, without warping or racking doors, and with specified clearances; anchor in place.

E. Set thresholds in continuous bed of sealant.

F. In masonry walls, install frames prior to laying masonry; anchor frames into masonry mortar joints; fill jambs with grout as walls are laid up.

G. In stud walls, install frames prior to building walls; anchor frames to studs using concealed anchors.

3.4 ADJUSTING

A. Lubricate, test, and adjust doors to operate easily, free from warp, twist or distortion, and to fit watertight for entire perimeter.

B. Adjust hardware for smooth and quiet operation.

C. Adjust doors to fit snugly and close without sticking or binding.

3.5 CLEANING

A. Clean installed products in accordance with manufacturer’s instructions prior to owner’s acceptance.

3.6 PROTECTION

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

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END OF SECTION

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SECTION 08 31 00 - ACCESS DOORS AND PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall- and ceiling-mounted access units, interior applications.

B. Weather-resistant wall-mounted access units, exterior applications.

1.2 RELATED REQUIREMENTS

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

1.3 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: For each type of access door unit provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Shop Drawings: Indicate exact position of each access door and/or panel unit.

D. Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation

E. Project Record Documents: Record actual locations of each access unit.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten (10) years documented experience.

B. Size Variations: Obtain Architect's approval of manufacturer's standard size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified under “Submittals” Article.

PART 2 PRODUCTS

2.1 WALL- AND CEILING-MOUNTED ACCESS UNITS

A. Manufacturers:

1. Activar Construction Products Group - JL Industries: www.activarcpg.com.
2. ACUDOR Products Inc: www.acudor.com.
3. Babcock-Davis: www.babcockdavis.com.
4. BAUCO Access Panel Solutions Inc: www.accesspanelsolutions.com.

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5. Best Access Doors: www.bestaccessdoors.com.
6. Cendrex, Inc: www.cendrex.com.
7. FF Systems, Inc: www.ffsystemsinc.com.
8. Karp Associates, Inc: www.karpinc.com.
9. MIFAB, Inc: www.mifab.com.
10. Nystrom, Inc: www.nystrom.com.
11. Substitutions: See Section 01 60 00 - Product Requirements.

B. Interior 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: Exposed frame with door surface flush with frame surface.
    a. Gypsum Board Mounting Criteria: Use drywall bead type frame.
3. Door Style: Single thickness with rolled or turned in edges.
4. Heavy-Duty Frames: 14-gauge, 0.0747-inch minimum thickness.
5. Heavy-Duty Single Steel Sheet Door Panels: 14-gauge, 0.0747-inch minimum thickness.
6. Door Panels to Receive Wall/Ceiling Finish: Surface recessed 5/8 inch back from wall face.
7. Steel Finish: Primed.
8. Door/Panel Size: 18 inch by 18 inch minimum, unless otherwise indicated; provide size(s) indicated on drawings.
9. Hardware:
    a. Hinges: Continuous piano hinge.
    b. Handle: No handle.
    c. Latch/Lock: Cylinder lock-operated cam latch, two keys for each unit.
    d. Number of Locks/Latches Required: As recommended by manufacturer for size(s) of unit(s).

C. Exterior Wall-Mounted Units: Weatherproof assembly with extruded neoprene gaskets around perimeter of door panel.

1. Material: Stainless steel, Type 304; No.4 brushed finish.
2. Style: Exposed frame with door surface flush with frame surface.
3. Frames: 16-gauge, 0.0598-inch minimum thickness.
4. Double-Skinned Insulated Steel Sheet Door Panels: 20-gauge, 0.0375-inch minimum thickness, on both sides and along each edge.
5. Insulation: Polyurethane or polyisocyanurate foam, 2 inch thick.

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6. Door/Panel Size: As indicated on the drawings.
7. Hardware:
    a. Hinges: Continuous piano hinge.
    b. Handle: Locking handle, interior and exterior.
    c. Number of Handles/Latches: As recommended by manufacturer for size(s) of unit(s).
8. Basis of Design:
    a. Activar/JL Industries; Weather-Resistant R13 Access Panel, Model XTS.

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. Clean surfaces thoroughly prior to proceeding with this work.

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

3.3 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

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SECTION 08 43 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Aluminum-framed storefront.

B. Aluminum entrances, doors and frames.

C. Weatherstripping.

1.2 RELATED REQUIREMENTS

A. Section 05 05 13 - Shop-Applied Coatings for Metal: Finish and color specifications.

B. Section 07 27 23 - Gypsum Sheathing Air Barriers: Sealing framing to air barrier membrane installed on adjacent construction.

C. Section 07 62 00 - Sheet Metal Flashing and Trim.

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

E. Section 08 71 00 - Door Hardware: Hardware items other than specified in this section.

F. Section 08 80 00 - Glazing: Glass and glazing accessories.

1.3 REFERENCE STANDARDS

A. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2015.

B. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems; 2024.

C. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum; 2025.

D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

E. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.

F. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

I. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

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J. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

K. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors; 2002 (Reapproved 2018).

L. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015 (Reapproved 2023).

M. OBC-2024 - 2024 Ohio Building Code; 2024.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting before starting work of this section; require attendance by all affected installers.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.

D. Samples: Comply with Section 05 05 13.

E. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

F. Installer's qualification statement.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least ten (10) years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least five (5) years of documented experience and approved by manufacturer.

1. Provide company, field supervisors, and installers that hold active ANSI accredited certifications in appropriate categories for work specified.

    a. North American Contractor Certification (NACC) for glazing contractors.

    b. Equivalent independent third-party ANSI accredited certification.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

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

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1.8 FIELD CONDITIONS

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

1.9 WARRANTY

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

B. Finish Warranty: Comply with Section 05 05 13.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. General: Provide either "Basis of Design" products by the basis of design manufacturer, or comparable products by of one of the other available manufacturers.

B. Aluminum-Framed Storefronts:

1. (Basis of Design) YKK AP America, Inc: www.ykkap.com/commercial.
2. Kawneer North America: www.kawneer.com.
3. Oldcastle BuildingEnvelope: www.oldcastlebe.com.
4. Tubelite, Inc: www.tubeliteinc.com.

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

1. For any product not identified as "Basis of Design", submit information as specified for substitutions.

2.2 BASIS OF DESIGN -- FRAMING

A. Front-Set Style, Thermally-Broken:

1. Basis of Design: YKK; YES 45 TU.

2.3 BASIS OF DESIGN -- FRAMING FOR MONOLITHIC GLAZING

A. Center-Set Style:

1. Basis of Design: YKK YES 40 FS.

2.4 BASIS OF DESIGN -- SWINGING DOORS

A. Interior Doors - ~~**Medium**~~ **Wide** Stile, Monolithic Glazing:

1. Basis of Design: YKK; ~~**35D**~~ **50D**.
2. Thickness: 1-3/4 inches.

B. Exterior Doors - ~~**Medium**~~ **Wide** Stile, Insulating Glazing, Thermally-Broken:

1. Basis of Design: YKK; MegaTherm ~~**35XT**~~ **50XT**.
2. Thickness: 2 inches.

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2.5 ALUMINUM-FRAMED STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.

1. Glazing Rabbet:
    a. Exterior Storefront: For 1 inch insulating glazing.
    b. Interior Storefront: For 3/8 inch glazing.
2. (MTL-3) Finish and Color: Color anodized specified in Section 05 05 13.
    a. Factory finish all surfaces that will be exposed in completed assemblies.
    b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
    c. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
3. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
4. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
6. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
7. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
8. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
9. Maintain continuous air barrier seal throughout assembly, primarily in line with glazing, and heel bead of glazing compound.

B. Performance Requirements

1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
    a. Design Wind Loads: Comply with requirements of ASCE 7 as required by OBC-2024.
    b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.

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2. Air Leakage: 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf pressure difference.
3. Condensation Resistance Factor of Framing: 65, minimum, measured in accordance with AAMA 1503.
4. Overall U-value Including Glazing: 0.35 Btu/(hr sq ft deg F), maximum.

2.6 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, drainage holes and internal weep drainage system.
1. Framing members for interior applications need not be thermally broken.
2. Glazing Stops: Flush.
3. Cross-Section: As indicated on drawings.

B. Glazing: See Section 08 80 00.

C. Swing Doors: Glazed aluminum.
1. Finish: Same as storefront.

2.7 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Fasteners: Stainless steel.

C. Exposed Flashings: Aluminum sheet, 20 gauge, 0.032 inch minimum thickness; finish to match framing members. See Section 07 62 00 for additional requirements.

D. Concealed Flashings: Stainless steel, 26 gauge, 0.0187 inch minimum thickness. See Section 07 62 00 for additional requirements.

E. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, compatible with flashing and air barrier materials.
1. Coordinate material compatibility with Section 07 27 23.

F. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

G. Glazing Accessories: See Section 08 80 00.

2.8 FINISHES

A. MTL-3: Comply with Section 05 05 13.

2.9 HARDWARE

A. For each door, include weatherstripping.

B. Other Door Hardware: See Section 08 71 00.

C. Weatherstripping: Wool pile, continuous and replaceable; provide on all exterior doors.

D. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all exterior doors.

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PART 3 EXECUTION

3.1 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.2 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Apply low-rise flexible spray-foam insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

1. Refer to Section 07 92 00 - Joint Sealants.

I. See Section 08 71 00 for hardware installation requirements.

J. Install glass using glazing methods indicated; see Section 08 80 00.

K. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.3 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.4 FIELD QUALITY CONTROL

A. Provide services of storefront manufacturer's field representative to observe for proper installation of system and submit report.

B. See Section 01 40 00 - Quality Requirements for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.

C. Water-Spray Test: Owner will provide water spray quality test of installed storefront components in accordance with AAMA 501.2 during construction process and before installation of interior finishes.

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1. Perform a minimum of two tests in each designated area as directed by Architect.
2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.

D. Owner will provide field testing of installed storefront system by independent laboratory in accordance with AAMA 503 during construction process and before installation of interior finishes.
   1. Perform a minimum of two tests in each designated area as indicated on drawings.
   2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.
   3. Field test for water penetration in accordance with ASTM E1105 with uniform static air pressure difference (Procedure A) not less than 4.18 psf.
      a. Maximum allowable rate of water penetration in 15-minute test is 0.5 ounce that is not contained in an area with provisions to drain to exterior, or collected on surface of interior horizontal framing member.
   4. Field test for air leakage in accordance with ASTM E783 with uniform static air pressure difference of 1.57 psf.
      a. Maximum allowable rate of air leakage is 0.09 cfm/sq ft.

E. Repair or replace storefront components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.5 ADJUSTING

A. Adjust operating hardware for smooth operation.

3.6 CLEANING

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

B. Remove protective material from pre-finished aluminum surfaces.

C. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

D. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.7 PROTECTION

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

END OF SECTION

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SECTION 08 44 13 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Aluminum-framed curtain wall systems.

1.2 RELATED REQUIREMENTS

A. Section 05 05 13 - Shop-Applied Coatings for Metal: Finish and color specifications.

B. Section 07 27 23 - Gypsum Sheathing Air Barriers: Sealing framing to air barrier membrane installed on adjacent construction.

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

D. Section 08 43 13 - Aluminum-Framed Entrances and Storefronts: Entrance doors and framing.

E. Section 08 80 00 - Glazing: Glass and glazing accessories.

1.3 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.

B. AAMA 501.1 - Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure; 2017.

C. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2015.

D. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems; 2024.

E. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum; 2025.

F. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

G. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

I. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

J. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015 (Reapproved 2022).

K. ASTM C793 - Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants; 2023.

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L. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).

M. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

N. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2023.

O. ASTM C1135 - Standard Test Method for Determining Tensile Adhesion Properties of Structural Sealants; 2019 (Reapproved 2024).

P. ASTM C1184 - Standard Specification for Structural Silicone Sealants; 2023.

Q. ASTM C1249 - Standard Guide for Secondary Seal for Sealed Insulating Glass Units for Structural Sealant Glazing Applications; 2018 (Reapproved 2023).

R. ASTM C1401 - Standard Guide for Structural Sealant Glazing; 2023.

S. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

T. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

U. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors; 2002 (Reapproved 2018).

V. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015 (Reapproved 2023).

W. OBC-2024 - 2024 Ohio Building Code; 2024.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting before starting work of this section. Review procedures for coordinated installation of wall assembly components by multiple subcontractors and to maintain thermal envelope, and air barrier assembly.

1. Require attendance by all affected installers, including:

a. Architect.

b. Owner.

c. Gypsum Sheathing Air Barrier Installation Superintendent.

d. Wall Insulation Installation Superintendent.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, internal drainage details, glazing, _____, and infill.

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C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.

1. Provide details of proposed structural sealant glazing (SSG) and weather sealant joints indicating dimensions, materials, bite, thicknesses, profile, and support framing.

2. Include design engineer's stamp or seal on shop drawings.

D. Samples: Comply with Section 05 05 13.

E. Design Data: Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations; include load calculations at points of attachment to building structure.

F. Structural Sealant Glazing (SSG): Submit product data and calculations showing compliance with performance requirements.

G. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

H. Designer's Qualification Statement.

1.6 QUALITY ASSURANCE

A. Designer Qualifications: Design curtain wall and its structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at Ohio.

B. Verify that each component is appropriate for use in structural sealant glazing (SSG) application in regards to at least the following properties: size, shape, dimensions, material, durability, storage conditions, and color.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than ten (10) years of documented experience.

1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.

a. Insulating Glass Certification Council (IGCC).

b. Safety Glazing Certification Council (SGCC).

D. Installer Qualifications: Company specializing in performing work of type specified and with at least five (5) years of documented experience.

1. Provide company, field supervisors, and installers that hold active ANSI accredited certifications in appropriate categories for work specified.

a. North American Contractor Certification (NACC) for glazing contractors.

b. Equivalent independent third-party ANSI accredited certification.

E. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

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1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping or strippable coating. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.8 FIELD CONDITIONS

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

1.9 WARRANTY

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

B. Finish Warranty: Comply with Section 05 05 13.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. General: Provide either "Basis of Design" products by the basis of design manufacturer, or comparable products by of one of the available manufacturers.

B. Glazed Aluminum Curtain Walls Manufacturers:

1. Kawneer North America: www.kawneer.com.

2. Oldcastle Building Envelope: www.oldcastlebe.com.

3. Tubelite, Inc: www.tubeliteinc.com.

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

1. For any product not identified as "Basis of Design", submit information as specified for substitutions.

2.2 BASIS OF DESIGN - CURTAIN WALL SYSTEMS

A. System available in multiple configurations; Pressure Cap Four Sides, Pressure Cap at Horizontals with Two (2)-Side SSG at Verticals, and Four (4)-Side SSG:

1. Basis of Design: YKK; YCW 750 SSG / 750 OG.

2.3 CURTAIN WALL

A. Aluminum-Framed Curtain Wall: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.

1. Provide configurations indicated on drawings:

a. Outside glazed, with pressure plate and mullion cover, four (4)-sides captured.

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b. SSG adhesive on two (2)-sides and pressure plate and mullion cover on two (2)-sides.

c. SSG adhesive on four (4)-sides.

2. Fabrication Method: Shop/factory unitized system.

3. Glazing Method: Either shop/factory or field glazed system.

4. (MTL-3) Finish and Color: Color anodized specified in Section 05 05 13.

a. Factory finish surfaces that will be exposed in completed assemblies.

b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

c. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

5. Provide flush joints and corners, weathersealed, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.

6. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.

7. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

B. Structural Performance Requirements: Design and size components to withstand the following load requirements without damage or permanent set.

1. Design Wind Loads: Comply with the requirements of ASCE 7 as required by OBC-2024.

a. Small Spans - Member Deflection: For spans less than 13 feet 6 inches, limit member deflection to flexure limit of glass in any direction, and maximum of 1/175 of span or 3/4 inch, whichever is less and with full recovery of glazing materials.

b. Large Spans - Member Deflection: For spans over 13 feet 6 inches and less than 40 feet, limit member deflection to flexure limit of glass in any direction, and maximum of 1/240 of span plus 1/4 inch, with full recovery of glazing materials.

2. Movement: Accommodate the following movement without damage to components or deterioration of seals:

a. Expansion and contraction caused by 180 degrees F surface temperature.

b. Expansion and contraction caused by cycling temperature range of 170 degrees F over a 12 hour period.

c. Movement of curtain wall relative to perimeter framing.

d. Deflection of structural support framing, under permanent and dynamic loads.

3. Structural Sealant Glazing (SSG) System: For individual glass lites, design framing members to not exceed a deflection normal to the wall of L/175 between supports with 3/4 inch maximum, and a deflection parallel to the wall of L/360 with 1/8 inch maximum, whichever is less.

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C. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on indoor face when tested as follows:

1. Test Pressure Differential: 15 psf for 4-sided captured; 20 psf for 2-sided SSG; 15 psf for 4-sided SSG.
2. Test Method: ASTM E331.
3. Test Method: AAMA 501.1.

D. Air Leakage: 0.06 cfm/sq ft maximum leakage of wall area when tested in accordance with ASTM E283/E283M at 6.24 psf pressure difference across assembly.

E. Thermal Performance Requirements:

1. Condensation Resistance Factor of Framing (CRF_f): Measured in accordance with AAMA 1503.
   a. 4-Sided Captured: 65, minimum.
   b. 2-Sided SSG: 74, minimum.
   c. 4-Sided SSG: 80, minimum.
2. Overall U-value Including Glazing:
   a. 4-Sided Captured: 0.41 BTU/(hr sq ft deg F), maximum.
   b. 2-Sided SSG: 0.35 Btu/(hr sq ft deg F), maximum.
   c. 4-Sided SSG: 0.32 BTU/(hr sq ft deg F), maximum.

2.4 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.

1. Cross-Section: As indicated on drawings.

B. Glazing: See Section 08 80 00.

2.5 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Fasteners: Stainless steel; type as required or recommended by curtain wall manufacturer.

C. Exposed Flashings: Aluminum sheet, 20-gauge, 0.032-inch minimum thickness; finish to match framing members. See Section 07 62 00 for additional requirements.

D. Concealed Flashings: Stainless steel, 26-gauge, 0.0187-inch minimum thickness. See Section 07 62 00 for additional requirements.

E. Structural Sealant Glazing (SSG) Adhesive: Neutral curing, silicone sealant formulated for SSG applications in compliance with ASTM C1184 and structural glazing industry guidelines, ASTM C1401.

1. SSG adhesive in compliance with ASTM C920; Type S - Single-component or Type M - Multicomponent, Grade NS, Class 50, Use NT, G, and A.

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2. Ultimate Tensile Strength: Minimum of 50 psi as determined by test method ASTM C1135 under the following conditions.
    a. Exposure to air temperatures of 190 degrees F and minus 20 degrees F.
    b. Water immersion for seven (7) days, minimum.
    c. Exposure to weathering for 5,000 hours, minimum.
3. Sealant Design Tensile Strength: 20 psi, maximum.
4. Hardness: 20 to 60 with Type A-2 durometer in compliance with test method ASTM C661.
5. Color: Black.
6. SSG sealant tested for compatibility with glazing accessories in compliance with ASTM C1087, tested for accelerated weathering in compliance with ASTM C793, and in compliance with insulating glass secondary sealant design standards of ASTM C1249.

F. Weatherseal Sealant: Silicone, with adhesion in compliance with ASTM C794; compatible with glazing accessories.

G. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, and compatible with flashing and air barrier materials.
    1. Coordinate material compatibility with Section 07 27 23.

H. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

I. Glazing Accessories: See Section 08 80 00.

2.6 FINISHES

A. MTL-3: Comply with Section 05 05 13.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other related work.

B. Verify that curtain wall openings and adjoining water-resistive and air barrier seal materials are ready to receive work of this section.

C. Verify that anchorage devices have been properly installed and located.

3.2 INSTALLATION

A. Install curtain wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

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D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Apply low-rise flexible spray-foam insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

1. Refer to Section 07 92 00 - Joint Sealants.

H. Pressure Plate Framing: Install glazing using glazing method required to achieve performance criteria; see Section 08 80 00.

I. Structural Sealant Glazing (SSG) Adhesive: Install structural sealant glazing adhesive and weatherseal sealant in accordance with manufacturer's instructions.

J. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.3 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet noncumulative or 0.5 inches per 100 feet, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

C. Sealant Space Between Curtain Wall Mullions and Adjacent Construction: Maximum of 3/4 inch and minimum of 1/4 inch.

3.4 FIELD QUALITY CONTROL

A. Provide services of curtain wall manufacturer's field representative to observe for proper installation of system and submit report.

B. See Section 01 40 00 - Quality Requirements for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.

C. Water-Spray Test: Owner will provide water spray quality test of installed curtain wall components in accordance with AAMA 501.2 during construction process and before installation of interior finishes.

1. Perform a minimum of two tests in each designated area as directed by Architect.

2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.

D. Owner will provide field testing of installed curtain wall system by independent laboratory in accordance with AAMA 503 during construction process and before installation of interior finishes.

1. Perform a minimum of two tests in each designated area as indicated on drawings.

2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.

3. Field test for water penetration in accordance with ASTM E1105 with uniform static air pressure difference (Procedure A) not less than 4.18 psf.

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a. Maximum allowable rate of water penetration in 15-minute test is 0.5 ounce that is not contained in an area with provisions to drain to exterior, or collected on surface of interior horizontal framing member.

4. Field test for air leakage in accordance with ASTM E783 with uniform static air pressure difference of 1.57 psf.

a. Maximum allowable rate of air leakage is 0.09 cfm/sq ft.

E. Repair or replace curtain wall components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.5 CLEANING

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

B. Remove protective material from pre-finished aluminum surfaces.

C. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, take care to remove dirt from corners, and wipe surfaces clean.

D. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.6 PROTECTION

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

END OF SECTION

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SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware
2. Electronic access control system components

B. Section excludes:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 01 "General Requirements" sections for Allowances, Alternates, Owner Furnished Contractor Installed, Project Management and Coordination.
2. Division 06 Section ''Rough Carpentry''
3. Division 06 Section ''Finish Carpentry''
4. Division 07 Section ''Joint Sealants'' for sealant requirements applicable to threshold installation specified in this section.
5. Division 08 Sections:
   a. ''Metal Doors and Frames''
   b. ''Flush Wood Doors''
   c. ''Interior Aluminum Doors and Frames''
   d. ''Aluminum-Framed Entrances and Storefronts''

   Division 26 ''Electrical'' sections for connections to electrical power system and for low-voltage wiring.
6. Division 28 ''Electronic Safety and Security'' sections for coordination with other components of electronic access control system and fire alarm system.

1.02 REFERENCES

A. UL LLC

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies

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3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 70 – National Electric Code
2. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
3. NFPA 101 – Life Safety Code
4. NFPA 105 – Smoke and Draft Control Door Assemblies
5. NFPA 252 – Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:
   a. Review drawings and Sections from related trades to verify compatibility with specified hardware.
   b. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
   a. Wiring Diagrams: For power, signal, and control wiring and including:

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1) Details of interface of electrified door hardware and building safety and security systems.
2) Schematic diagram of systems that interface with electrified door hardware.
3) Point-to-point wiring.
4) Risers.

3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.
   a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule:
   a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
   b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
   c. Indicate complete designations of each item required for each opening, include:
      1) Door Index: door number, heading number, and Architect's hardware set number.
      2) Quantity, type, style, function, size, and finish of each hardware item.
      3) Name and manufacturer of each item.
      4) Fastenings and other pertinent information.
      5) Location of each hardware set cross-referenced to indications on Drawings.
      6) Explanation of all abbreviations, symbols, and codes contained in schedule.
      7) Mounting locations for hardware.
      8) Door and frame sizes and materials.
      9) Degree of door swing and handing.
      10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.

5. Key Schedule:
   a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
   b. Use ANSI/BHMA A156.28 ''Recommended Practices for Keying Systems'' as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
   c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.

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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.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

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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:

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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.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.

C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.

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D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.06 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.07 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.

1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.
    a. Mechanical Warranty
        1) Locks
            a) Schlage L Series: 10 years
        2) Exit Devices
            a) Von Duprin: 10 years
        3) Closers
            a) LCN 4050 Series: 25 years
        4) Automatic Operators
            a) LCN: 2 years
    b. Electrical Warranty

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1) Locks
    a) Schlage: 3 years
2) Exit Devices
    a) Von Duprin: 3 years

1.08 MAINTENANCE

A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The Owner requires use of certain products for their unique characteristics and project suitability to ensure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: ''Owner’s Standard.''

    1. Where ''Owner’s Standard” 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.

2.02 MATERIALS

A. Fabrication

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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.

2.03 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. Best FBB series

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Provide five knuckle, ball bearing hinges.
3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
   a. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
   b. Interior: Heavy weight, steel, 4-1/2 inches (114 mm) high

4. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
   a. Interior: Heavy weight, steel, 5 inches (127 mm) high

5. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
6. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
7. 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 Interior Lockable Doors: Non-removable pins
   d. Interior Non-lockable Doors: Non-rising pins

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8. 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.

2.04 CONTINUOUS HINGES

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

2. Acceptable Manufacturers:
   a. Select

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 (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 ELECTRIC POWER TRANSFER

A. Manufacturers:

1. Scheduled Manufacturer and Product:
   a. Von Duprin EPT-10

2. Acceptable Manufacturers and Products:
   a. Owner’s Standard

B. Requirements:

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1. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
2. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

2.06 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 (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

2.07 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.

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2.08 MORTISE LOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. Schlage L9000 series

2. Acceptable Manufacturers and Products:
   a. Owner's Standard

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3-hour fire doors.
2. Indicators: Where specified, provide indicator window measuring a minimum 2-inch x 1/2 inch with 180-degree visibility. Provide messages color-coded with full text and/or symbols, as scheduled, for easy visibility.
3. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
4. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
5. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1-inch (25 mm) throw, constructed of stainless steel.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide switches and sensors integrated into the locks and latches. Provide motor based electrified and motor based latch retraction locksets that comply with the following requirements:
   a. Universal input voltage – single chassis accepts 12 or 24VDC to allow for changes in the field without changing lock chassis.
   b. Fail Safe/Fail Secure – changing mode between electrically locked (fail safe) and electrically unlocked (fail secure) is field selectable without opening the lock case
   c. Low maximum current draw – maximum 0.4 amps (Lever control) and maximum 2.0 amps (Latch retraction) to allow for multiple locks on a single power supply.
   d. Low holding current (Lever control or latch retraction) – maximum 0.01 amps to produce minimal heat, eliminate "hot levers" in electrically locked applications and motorized latch retraction applications, and to provide reliable operation in wood doors that provide minimal ventilation and air flow.
   e. Connections – provide quick-connect Molex system standard.

8. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
   a. Lever Design: 02A.

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2.09 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. Von Duprin 98/35A series

2. Acceptable Manufacturers and Products:
   a. Owner’s Standard

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

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1) Provide cable-actuated concealed vertical latch system in two-point for non-rated or fire rated wood doors up to a 90 minute rating and less bottom latch (LBL) configuration for non-rated or fire rated wood doors up to 20 minute rating. Vertical rods not permitted.
   a) Cable: Stainless steel with abrasive resistant coating. Conduit and core wire ends snap into latch and center slides without use of tools.
   b) Wood Door Prep: Maximum 1 inch x 1.1875 inch x 3.875 inches top latch pocket and 1 inch x 1.1875 inch x 5 inches bottom latch pocket which does not require the use of a metal wrap or edge for non-rated or fire rated wood doors up to a 45 minute rating.
   c) Latchbolts and Blocking Cams: Manufactured from sintered metal low carbon copper- infiltrated steel, with molybdenum disulfide low friction coating.
   d) Top Latchbolt: Minimum 0.38 inch (10 mm) and greater than 90-degree engagement with strike to prevent door and frame separation under high static load.
   e) Bottom Latchbolt: Minimum of 0.44-inch (11 mm) engagement with strike.
   f) Product Cycle Life: 1,000,000 cycles.
   g) Latch Operation: Top and bottom latch operate independently of each other. Top latch fully engages top strike even when bottom latch is compromised. Separate trigger mechanisms not permitted.
   h) Latch release does not require separate trigger mechanism.
   i) Cable and latching system characteristics:
      i. Installed independently of exit device installation, and capable of functioning on door prior to device and trim installation.
      ii. Connected to exit device at single point in steel and aluminum doors, and two points for top and bottom latches in wood doors.
      iii. Bottom latch height adjusted, from single point for steel and aluminum doors and two points for wood doors, after system is installed and connected to exit device, while door is hanging
      iv. Bottom latch position altered up and down minimum of 2 inches (51 mm) in steel and aluminum doors without additional adjustment. Bottom latch deadlocks in every adjustment position in wood doors.
      v. Top and bottom latches in steel and aluminum doors and top latch in wood doors may be removed while door is hanging.

2.10 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

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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.

2.11 POWER SUPPLIES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. Schlage/Von Duprin PS900 Series

2. Acceptable Manufacturers and Products:
   a. Owner's Standard

B. Requirements:

1. Provide power supplies approved by manufacturer of supplied electrified hardware.
2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
4. Provide power supplies with the following features:
   a. 12/24 VDC Output, field selectable.
   b. Class 2 Rated power limited output.
   c. Universal 120-240 VAC input.
   d. Low voltage DC, regulated and filtered.
   e. Polarized connector for distribution boards.
   f. Fused primary input.
   g. AC input and DC output monitoring circuit w/LED indicators.
   h. Cover mounted AC Input indication.
   i. Tested and certified to meet UL294.
   j. NEMA 1 enclosure.
   k. Hinged cover w/lock down screws.
   l. High voltage protective cover.

2.12 CYLINDERS

A. Manufacturers:

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1. Scheduled Manufacturer and Product:
   a. Corbin-Russwin – Match Existing

2. Acceptable Manufacturers and Products:
   a. Owner's Standard

B. Requirements:

1. Provide cylinders/cores to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.

2.13 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.

2. Existing factory registered system:
   a. Provide cylinders/cores keyed into Owner's existing factory registered keying system. Comply with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

3. Existing non-factory registered system:
   a. Provide cylinders/cores keyed into Owner's existing keying system managed by Owner's locksmith, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference. Contact:
      1) Firm Name:
      2) Contact Person:
      3) Telephone:

B. Requirements:

1. Construction Keying:
   a. Temporary Construction Cylinder Keying.
      1) Provide construction cores that permit voiding construction keys without cylinder removal, furnished in accordance with the following requirements.
         a) Split Key or Lost Ball Construction Keying System.
         b) 3 construction control keys, and extractor tools or keys as required to void construction keying.
         c) 12 construction change (day) keys.
      2) Owner or Owner's Representative will void operation of temporary construction keys.
   b. Replaceable Construction Cores.

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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 bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
   c. Provide keys with the following features:
      1) Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
      2) Patent Protection: Keys and blanks protected by one or more utility patent(s).
      3) Geographically Exclusive: Where High Security or Security cylinders/cores are indicated, provide nationwide, geographically exclusive key system complying with the following restrictions.
   d. Identification:
      1) Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
      2) Identification stamping provisions must be approved by the Architect and Owner.
      3) Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
      4) Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
      5) Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
   e. Quantity: Furnish in the following quantities.
      1) Permanent Control Keys: 3.
      2) Master Keys: 6.
      3) Change (Day) Keys: 3 per cylinder/core that is keyed differently
      4) Key Blanks: Quantity as determined in the keying meeting.

2.14 KEY CONTROL SYSTEM

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Telkee

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2. Acceptable Manufacturers:
   a. HPC
   b. Lund

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 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. LCN 4050A series

2. Acceptable Manufacturers and Products:
   a. Falcon SC70A 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 cast aluminum cylinder.
3. Closer Body: 1-1/2-inch (38 mm) diameter with 11/16-inch (17 mm) diameter heat-treated pinion journal and full complement bearings.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and all weather requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and back check.
7. Pressure Relief Valve (PRV) Technology: Not permitted.
8. Provide stick on templates, 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.

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2.16 ELECTRO-HYDRAULIC AUTOMATIC OPERATORS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. LCN 4600 series

2. Acceptable Manufacturers and Products:
   a. Stanley

B. Requirements:

1. Provide low energy automatic operator units with hydraulic closer complying with ANSI/BHMA A156.19.
2. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
3. Provide units with conventional door closer opening and closing forces unless power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check, and opening and closing speed adjustment valves to control door
4. Provide units with on/off switch for manual operation, motor start up delay, vestibule interface delay, electric lock delay, and door hold open delay.
5. Provide drop plates, brackets, and adapters for arms as required for details.
6. Provide actuator switches and receivers for operation as specified.
7. Provide weather-resistant actuators at exterior applications.
8. Provide key switches with LED's, recommended and approved by manufacturer of automatic operator as required for function described in operation description of hardware group below. Cylinders: Refer to ''KEYING'' article, herein.
9. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.
10. Provide units with vestibule inputs that allow sequencing operation of two units, and SPDT relay for interfacing with latching or locking devices.

2.17 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

2. Acceptable Manufacturers:
   a. Burns
   b. Trimco

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B. Requirements:

1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

2.18 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 (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.
3. At fire rated doors, provide protection plates over 16 inches high with UL label.

2.19 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers:
   a. Glynn-Johnson

2. Acceptable Manufacturers:
   a. Rixson

B. Requirements:

1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.

2.20 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

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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.

2.21 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 (762 mm) of height on each single frame, and two for each pair frame.
   a. Zero International
   b. No Substitute
   c. National Guard
   d. Reese
   e. Pemko

3. Omit where gasketing is specified.

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

A. Manufacturers:

B. Scheduled Manufacturer:

1. Zero International

C. Acceptable Manufacturers:

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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 UL10C 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.

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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.

2.23 DOOR POSITION SWITCHES

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Schlage

2. Acceptable Manufacturers:
   a. GE-Interlogix

B. Requirements:

1. Provide recessed or surface mounted type door position switches as specified.
2. Coordinate door and frame preparations with door and frame suppliers. If switches are being used with magnetic locking device, provide minimum of 4 inches (102 mm) between switch and magnetic locking device.

2.24 FINISHES

A. FINISH: BHMA 626/652 (US26D); EXCEPT:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Aluminum Geared Continuous Hinges: BHMA 628 (US28)
3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
4. Protection Plates: BHMA 630 (US32D)
5. Overhead Stops and Holders: BHMA 630 (US32D)
6. Door Closers: Powder Coat to Match
7. Wall Stops: BHMA 630 (US32D)
8. Latch Protectors: BHMA 630 (US32D)
9. Weatherstripping: Clear Anodized Aluminum
10. Thresholds: Mill Finish Aluminum

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PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

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

3.02 INSTALLATION

A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
4. Installation Guide for Doors and Hardware: DHI TDH-007-20

B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.

C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.

D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

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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.

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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.

3.03 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
2. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.04 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items per manufacturer's instructions to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

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3.05 DOOR HARDWARE SCHEDULE

A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.

C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.

D. Hardware Sets:

Hardware Group No. 001
For use on Door #(s):
101A 116A
Provide each PR door(s) with the following:

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QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	112HD EPT		313AN	IVE
2	EA	POWER TRANSFER	EPT10		695	VON
1	EA	ELEC PANIC HARDWARE	LX-RX-QEL-3549A-EO 24 VDC		643E	VON
1	EA	ELEC PANIC HARDWARE	LX-RX-QEL-3549A-NL-OP-388 24 VDC		643E	VON
1	EA	RIM CYLINDER	3080 -- BLOCKING RING AS REQUIRED.		613	C-R
1	EA	FINAL CORE	8000		606	C-R
2	EA	90 DEG OFFSET PULL	8190HD 18" O		643E/716	IVE
2	EA	OVERHEAD STOP	100S		613	GLY
1	EA	DOOR CLOSER	4050A REG - (TOP JAMB MOUNT)		695	LCN
1	EA	SURF. AUTO OPERATOR	4642 REG		695	LCN
1	EA	MOUNTING PLATE	4050A-18G		695	LCN
1	EA	WEATHER RING	8310-801 - (at exterior actuator only)		PLA	LCN
1	EA	ACTUATOR, JAMB MOUNT	8310-818T		630	LCN
1	EA	FLUSH MOUNT BOX	8310-819F		689	LCN
1	EA	ACTUATOR, WALL MOUNT	8310-853T		630	LCN
1	EA	MOUNTING BOX	8310-867F			LCN
1	EA	BOLLARD POST	B-6SQ-RT-32D-CS-SQ25		US32D	WIK
1	EA	DOOR SEAL	FURNISHED UNDER SECTION 08_41_00.		AL	B/O
1	EA	MEETING STILE ASTRAGAL	FURNISHED UNDER SECTION 08_41_00.		AL	B/O
2	EA	DOOR SWEEP	8198D		D	ZER
1	EA	THRESHOLD	654A-E		A	ZER
1	EA	CARD READER	FURNISHED BY THE SECURITY CONTRACTOR.		BLK	B/O
2	EA	DOOR POS. SWITCH	679-05HM		BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 900-BBK			VON
1	EA		RISER/ELEVATION DRAWING			
1	EA		POINT TO POINT DIAGRAM			

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NOTES:
1. THE 'LX' SWITCHES INSIDE THE EXIT DEVICES SHALL BE WIRED IN SERIES WITH THE VESTIBULE ACTUATOR.
2. THE WALL ACTUATOR ON THE INSIDE OF THE OPENING SHALL ALWAYS BE ENABLED.
3. THE 'RX' SWITCHES INSIDE THE EXIT DEVICES SHALL BE WIRED TO THE 'RX' TERMINALS OF THE ACCESS CONTROL SYSTEM.
4. THE DOOR POSITION SWITCHES SHALL BE WIRED TO THE 'DPS' TERMINALS OF THE ACCESS CONTROL SYSTEM.

OPERATIONAL DESCRIPTION:
1. THE DOORS SHALL BE NORMALLY CLOSED AND LOCKED.
2. FREE EGRESS SHALL ALWAYS BE POSSIBLE.
3. THE CARD READER SHALL CONTROL THE LOCKING AND UNLOCKING OF THE OPENING.
4. PRESENTING A VALID CREDENTIAL TO THE CARD READER WILL CAUSE THE FOLLOWING SIMULTANEOUS ACTIONS TO OCCUR:
A. THE LATCHBOLTS ON THE EXIT DEVICES SHALL RETRACT, UNLOCKING THE OPENING.
B. THE VESTIBULE WALL ACTUATOR SHALL BE ENABLED.
C. ANY ALARMS ASSOCIATED WITH THE OPENING OF THE DOOR SHALL BE SHUNTED.
5. IN THIS UNLOCK MODE, EITHER WALL ACTUATOR MAY BE PUSHED TO ACTIVATE THE AUTOMATIC OPERATOR AND OPEN THE DOOR.
6. WHEN THE CARD READER STRIKE TIME EXPIRES, THE FOLLOWING ACTIONS WILL OCCUR:
A. POWER TO THE EXIT DEVICES WILL BE REMOVED, CAUSING THE LATCHBOLTS TO EXTEND AND RE-SECURE THE OPENING.
B. THE VESTIBULE WALL ACTUATOR WILL BE DISABLED.
7. IN THIS LOCK MODE, THE INTERIOR ACTUATOR MAY STILL BE PUSHED TO ACTIVATE THE SYSTEM AND OPEN THE DOOR.
8. WHEN THE INTERIOR ACTUATOR IS PUSHED DURING A LOCK MODE, THE FOLLOWING SEQUENTIAL ACTIONS WILL OCCUR:
A. POWER TO THE EXIT DEVICES WILL BE APPLIED, CAUSING THE LATCHBOLTS TO RETRACT AND UNLOCK THE DOOR.
B. THE AUTOMATIC OPERATOR WILL BE ACTIVATED AND OPEN THE DOOR.
C. ANY ALARMS ASSOCIATED WITH THE DOOR POSITION SWITCH WILL BE SHUNTED.
9. ONCE THIS CYCLE HAS BEEN COMPLETED, THE DOOR WILL RETURN TO A CLOSED AND LOCKED STATE.
10. THE DOORS MAY BE OPERATED MANUALLY FROM THE INSIDE AT ALL TIMES.
11. WHEN AN INDIVIDUAL PUSHES ON THE TOUCHPAD OF EITHER EXIT DEVICE, THE FOLLOWING ACTIONS WILL OCCUR:
A. THE LATCHBOLTS WILL MECHANICALLY RETRACT, UNLOCKING THE DOOR TO ALLOW THE INDIVIDUAL TO EGRESS.
B. THE 'RX' SWITCH INSIDE THE EXIT DEVICE WILL CLOSE, SHUNTING ANY ALARMS ASSOCIATED WITH THE OPENING OF THE DOOR.

LOSS OF POWER:
1. THE DOORS SHALL REMAIN CLOSED AND LOCKED UPON LOSS OF POWER.
2. MECHANICAL OPERATION OF THE OPENING IS STILL POSSIBLE.
3. FREE EGRESS SHALL ALWAYS BE POSSIBLE.

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Hardware Group No. 002
For use on Door #(s):
101B 116B
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	112HD		313AN	IVE
2	EA	DUMMY PUSH BAR	350		643E	VON
2	EA	90 DEG OFFSET PULL	8190HD 18" O		643E/716	IVE
2	EA	OVERHEAD STOP	100S		613	GLY
1	EA	DOOR CLOSER	4050A REG - (TOP JAMB MOUNT)		695	LCN
1	EA	SURF. AUTO OPERATOR	4642 REG		695	LCN
1	EA	MOUNTING PLATE	4050A-18G		695	LCN
1	EA	ACTUATOR, JAMB MOUNT	8310-818T		630	LCN
1	EA	FLUSH MOUNT BOX	8310-819F		689	LCN
1	EA	ACTUATOR, WALL MOUNT	8310-853T		630	LCN
1	EA	MOUNTING BOX	8310-867F			LCN
1	EA	DOOR SEAL	FURNISHED UNDER SECTION 08_41_00.		AL	B/O
1	EA	MEETING STILE ASTRAGAL	FURNISHED UNDER SECTION 08_41_00.		AL	B/O
1	EA		RISER/ELEVATION DRAWING			
1	EA		POINT TO POINT DIAGRAM			

NOTES:
1. THE ACTUATORS ON BOTH SIDES OF THE OPENING SHALL ALWAYS BE ENABLED.

OPERATIONAL DESCRIPTION:
1. THE DOOR SHALL BE NORMALLY CLOSED AND UNLOCKED.
2. FREE EGRESS SHALL ALWAYS BE POSSIBLE.
3. PUSHING EITHER ACTUATOR WILL ACTIVATE THE AUTOMATIC OPERATOR AND OPEN THE DOOR.
4. THE DOOR WILL RETURN TO A CLOSED AND UNLOCKED STATE ONCE THE AUTOMATIC OPERATOR COMPLETES ITS CYCLE.

LOSS OF POWER:
1. THE DOOR WILL REMAIN CLOSED AND UNLOCKED UPON LOSS OF POWER.
2. FREE EGRESS SHALL ALWAYS BE POSSIBLE AT ALL TIMES.

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Hardware Group No. 003
For use on Door #(s):
102 103 110 122
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	L9070L 02A		626	SCH
1	EA	MORTISE CYLINDER	1080 A06		626	C-R
1	EA	INTERCHANGEABLE CORE	8000		626	C-R
1	EA	WALL STOP	WS401CCV		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

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Hardware Group No. 004
For use on Door #(s):
104
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
1	EA	CONT. HINGE	112HD EPT			313AN	IVE
1	EA	POWER TRANSFER	EPT10			695	VON
1	EA	ELEC PANIC HARDWARE	RX2-35A-NL-OP-388-LS-ALK 9-VOLT BATTERY WITH HARDWIRED OPTION			643E	VON
1	EA	RIM CYLINDER	3080 -- BLOCKING RING AS REQUIRED.			613	C-R
1	EA	FINAL CORE	8000			606	C-R
1	EA	ELECTRIC STRIKE	6113 FSE BSS 24VDC			613	VON
1	EA	90 DEG OFFSET PULL	8190HD 18" O			643E/716	IVE
1	EA	OVERHEAD STOP	100S			613	GLY
1	EA	DOOR CLOSER	4050A REG - (TOP JAMB MOUNT)			695	LCN
1	EA	MOUNTING PLATE	4050A-18G			695	LCN
1	EA	DOOR SEAL	FURNISHED UNDER SECTION 08_41_00.			AL	B/O
1	EA	DOOR SWEEP	8198D			D	ZER
1	EA	THRESHOLD	654A-E			A	ZER
1	EA	CARD READER	FURNISHED BY THE SECURITY CONTRACTOR.			BLK	B/O
1	EA	DOOR POS. SWITCH	679-05HM			BLK	SCE
1	EA	POWER SUPPLY	PS904 900-4RL 900-BBK				VON
1	EA		RISER/ELEVATION DRAWING				
1	EA		POINT TO POINT DIAGRAM				

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NOTES:
1. THE 679-05 DOOR POSITION SWITCH SHALL BE WIRED TO THE 'DPS' TERMINALS OF THE ACCESS CONTROL SYSTEM.
2. THE FIRST POLE OF THE 'RX2' SWITCH INSIDE THE EXIT DEVICE SHALL BE WIRED TO THE 'RX' TERMINALS OF THE ACCESS CONTROL SYSTEM.
3. THE SECOND POLE OF THE 'RX2' SWITCH INSIDE THE EXIT DEVICE SHALL BE WIRED TO THE EXIT ALARM KIT IN THE FOLLOWING MANNER:
A. WIRE THE COMMON FROM THE 'RX2' SWITCH TO THE 'RX/LX' SWITCH OF THE ALARM KIT.
B. WIRE THE NORMALLY OPEN FROM THE 'RX2' SWITCH TO THE 'TB1' TERMINAL OF THE ALARM KIT.
4. WIRE THE + TERMINAL ON THE ALARM KIT TO THE + TERMINAL OF THE PS902 POWER SUPPLY.
5. WIRE THE -- TERMINAL ON THE ALARM KIT TO THE -- TERMINAL OF THE PS902 POWER SUPPLY.
6. WIRE THE CARD READER OUTPUT TERMINALS TO THE 900-4RL OPTION BOARD INSIDE THE POWER SUPPLY IN THE FOLLOWING MANNER:
A. CONNECT THE COMMON FROM THE CARD READER OUTPUT TERMINALS TO THE 'SC' TERMINAL ON THE 900-4RL OPTION BOARD.
B. CONNECT THE NORMALLY OPEN FROM THE CARD READER OUT TERMINALS TO THE 'I1' TERMINAL ON THE 900-4RL OPTION BOARD.
7. CONNECT THE 'E1' TERMINAL ON THE ALARM KIT TO THE 'C2' TERMINAL ON THE 900-4RL OPTION BOARD.
8. CONNECT THE 'TB2' TERMINAL ON THE ALARM KIT TO THE 'NO2' TERMINAL ON THE 900-4RL OPTION BOARD.
9. CONNECT THE FIRST WIRE FROM THE 6113 ELECTRIC STRIKE TO THE 'GND' TERMINAL ON THE 900-4RL OPTION BOARD.
10. CONNECT THE SECOND WIRE FROM THE 6113 ELECTRIC STRIKE TO THE 'NO1' TERMINAL ON THE 900-4RL OPTION BOARD.

OPERATIONAL DESCRIPTION:
1. THE DOOR SHALL BE NORMALLY CLOSED AND LOCKED.
2. AUTHORIZED EGRESS IS POSSIBLE BY MOMENTARILY SHUNTING THE SYSTEM.
3. THE CARD READER SHALL CONTROL THE LOCKING AND UNLOCKING OF THE OPENING.
4. PRESENTING A VALID CREDENTIAL TO THE CARD READER SHALL CAUSE THE FOLLOWING ACTIONS TO OCCUR:
A. THE ELECTRIC STRIKE WILL BE ENERGIZED, UNLOCKING THE DOOR.
B. THE ALARM KIT WILL BE SHUNTED, ALLOWING THE AUTHORIZED INDIVIDUAL TO OPEN THE DOOR.
C. ANY ALARMS ASSOCIATED WITH THE OPENING OF THE DOOR WILL BE SHUNTED.
5. WHEN THE STRIKE TIME ON THE CARD READER ELAPSES, POWER TO THE ELECTRIC STRIKE WILL BE REMOVED AND RESECURE THE OPENING.

UNAUTHORIZED EGRESS:
1. WHEN AN UNAUTHORIZED INDIVIDUAL PUSHES ON THE TOUCHPAD OF THE EXIT DEVICE IN AN ATTEMPT TO EGRESS, THE EXIT ALARM WILL BE ACTIVATED, ALERTING AUTHORIZED PERSONNEL OF THE VIOLATION.
2. THE ALARM WILL CONTINUE TO SOUND UNTIL IT IS MANUALLY RESET BY AN AUTHORIZED INDIVIDUAL.

LOSS OF POWER:

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1. THE DOOR WILL REMAIN CLOSED AND LATCHED UPON LOSS OF POWER.

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Hardware Group No. 005
For use on Door #(s):
106
Provide each UEP door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
8	EA	HINGE	5BB1 4.5 X 4.5 NRP			652	IVE
1	EA	POWER TRANSFER	EPT10			689	VON
1	SET	CONST LATCHING BOLT	FB51P 24"			BLK	IVE
1	EA	DUST PROOF STRIKE	DP2			626	IVE
1	EA	EU MORTISE LOCK	L9092LEU 02A RX LX CON 12/24 VDC 1" STRIKE LIP LENGTH			626	SCH
1	EA	MORTISE CYLINDER	1080 A06			626	C-R
1	EA	INTERCHANGEABLE CORE	8000			626	C-R
1	EA	COORDINATOR	COR X FL			628	IVE
2	EA	MOUNTING BRACKET	MB			689	IVE
2	EA	DOOR CLOSER	4050A SCUSH			689	LCN
2	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS			630	IVE
2	EA	SILENCER	SR64			GRY	IVE
1	EA	CARD READER	FURNISHED BY THE SECURITY CONTRACTOR.			BLK	B/O
2	EA	DOOR POS. SWITCH	679-05HM			BLK	SCE
1	EA	POWER SUPPLY	PS902 900-BBK				VON
1	EA		RISER/ELEVATION DRAWING				
1	EA		POINT TO POINT DIAGRAM				

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NOTES:
1. CONNECT THE DOOR POSITION SWITCH TO THE 'DPS' TERMINALS OF THE ACCESS CONTROL SYSTEM.
2. CONNECT THE 'RX' SWITCH INSIDE THE MORTISE LOCK TO THE 'RX' TERMINALS OF THE ACCESS CONTROL SYSTEM.

OPERATIONAL DESCRIPTION:
1. THE DOOR SHALL BE NORMALLY CLOSED AND LOCKED.
2. FREE EGRESS SHALL ALWAYS BE POSSIBLE.
3. PRESENTING A VALID CREDENTIAL TO THE CARD READER WILL CAUSE THE FOLLOWING ACTIONS TO OCCUR:
A. THE LEVER-HANDLE ON THE LOCKSET WILL ELECTRICALLY UNLOCK TO ALLOW ACCESS.
B. ANY ALARMS ASSOCIATED WITH THE OPENING OF THE DOOR WILL BE SHUNTED.
4. ONCE THE STRIKE TIME ON THE CARD READER HAS EXPIRED, THE DOOR SHALL RETURN TO A CLOSED AND LOCKED STATE.
5. WHEN AN OCCUPANT OPERATES THE INSIDE LEVER IN AN ATTEMPT TO EGRESS, THE FOLLOWING ACTIONS WILL OCCUR:
A. THE LATCHBOLT ON THE LOCKSET WILL MECHANICALLY RETRACT, ALLOWING THE OCCUPANT TO EGRESS THROUGH THE OPENING.
B. THE 'RX' SWITCH WILL CLOSE AND SHUNT ANY ALARMS ASSOCIATED WITH THE OPENING OF THE DOOR.
6. THE DOOR WILL REMAIN CLOSED AND LOCKED UPON LOSS OF POWER.

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Hardware Group No. 006
For use on Door #(s):
107
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
8	EA	HINGE	5BB1HW 4.5 X 4.5 NRP			652	IVE
2	EA	POWER TRANSFER	EPT10			689	VON
2	EA	ELEC PANIC HARDWARE	RX-QEL-9827-L-NL-LBR-02 24 VDC			626	VON
2	EA	RIM CYLINDER	3080 - Blocking Ring as required.			626	C-R
2	EA	INTERCHANGEABLE CORE	8000			626	C-R
2	EA	DOOR CLOSER	4050A SCUSH			689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS			630	IVE
2	EA	SILENCER	SR64			GRY	IVE
1	EA	CARD READER	FURNISHED BY THE SECURITY CONTRACTOR.			BLK	B/O
2	EA	DOOR POSITION SWITCH	FURNISHED BY THE SECURITY CONTRACTOR.			BLK	B/O
1	EA	POWER SUPPLY	PS902 900-2RS 900-BBK				VON
1	EA		RISER/ELEVATION DRAWING				
1	EA		POINT TO POINT DIAGRAM				

NOTES:
1. THE DOOR POSITION SWITCH SHALL BE WIRED TO THE 'DPS' TERMINALS OF THE ACCESS CONTROL SYSTEM.
2. THE 'RX' SWITCHES INSIDE THE EXIT DEVICES SHALL BE WIRED TO THE 'RX' TERMINALS OF THE ACCESS CONTROL SYSTEM.

OPERATIONAL DESCRIPTION:
1. THE DOORS SHALL BE NORMALLY CLOSED AND LATCHED.
2. FREE EGRESS SHALL ALWAYS BE POSSIBLE.
3. THE CARD READER SHALL CONTROL THE LOCKING AND UNLOCKING OF THE OPENING.
4. PRESNTING A VALID CREDENTIAL TO THE CARD READER SHALL CAUSE THE FOLLOWING SIMULTANEOUS ACTIONS TO OCCUR:
A. THE LATCHBOLTS ON THE EXIT DEVICES SHALL RETRACT, UNLOCKING THE DOORS TO ALLOW ACCESS.
B. ANY ALARMS ASSOCIATED WITH THE OPENING OF THE DOORS SHALL BE SHUNTED.
5. ONCE THE STRIKE TIME ON THE CARD READER EXPIRES, POWER TO THE EXIT DEVICES WILL BE REMOVED, CAUSING THE LATCHBOLTS TO EXTEND AND RESECURE THE OPENING.
6. WHEN AN INDIVIDUAL PUSHES ON THE TOUCHPAD OF THE EXIT DEVICES IN AN ATTEMPT TO EGRESS, THE FOLLOWING ACTIONS WILL OCCUR:
A. THE 'RX' SWITCH INSIDE THE EXIT DEVICE WILL CLOSE AND SHUNT ANY ALARMS ASSOCIATED WITH THE OPENING OF THE DOOR.
7. THE DOORS SHALL REMAIN CLOSED AND LOCKED UPON LOSS OF POWER.

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Hardware Group No. 007
For use on Door #(s):
107A
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	L9080L 02A		626	SCH
1	EA	MORTISE CYLINDER	1080 A06		626	C-R
1	EA	INTERCHANGEABLE CORE	8000		626	C-R
1	EA	OVERHEAD STOP	100S		630	GLY
3	EA	SILENCER	SR64		GRY	IVE

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Hardware Group No. 008
For use on Door #(s):
107B
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5 NRP			652	IVE
1	EA	POWER TRANSFER	EPT10			689	VON
1	EA	EU MORTISE LOCK	L9092LEU 02A RX LX CON 12/24 VDC			626	SCH
1	EA	MORTISE CYLINDER	1080 A06			626	C-R
1	EA	INTERCHANGEABLE CORE	8000			626	C-R
1	EA	SURFACE CLOSER	4050A EDA			689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS			630	IVE
1	EA	WALL STOP	WS401CCV			626	IVE
3	EA	SILENCER	SR64			GRY	IVE
1	EA	CARD READER	FURNISHED BY THE SECURITY CONTRACTOR.			BLK	B/O
1	EA	DOOR POS. SWITCH	679-05HM			BLK	SCE
1	EA	POWER SUPPLY	PS902 900-BBK				VON
1	EA		RISER/ELEVATION DRAWING				
1	EA		POINT TO POINT DIAGRAM				

NOTES:
1. CONNECT THE DOOR POSITION SWITCH TO THE 'DPS' TERMINALS OF THE ACCESS CONTROL SYSTEM.
2. CONNECT THE 'RX' SWITCH INSIDE THE MORTISE LOCK TO THE 'RX' TERMINALS OF THE ACCESS CONTROL SYSTEM.

OPERATIONAL DESCRIPTION:
1. THE DOOR SHALL BE NORMALLY CLOSED AND LOCKED.
2. FREE EGRESS SHALL ALWAYS BE POSSIBLE.
3. PRESENTING A VALID CREDENTIAL TO THE CARD READER WILL CAUSE THE FOLLOWING ACTIONS TO OCCUR:
A. THE LEVER-HANDLE ON THE LOCKSET WILL ELECTRICALLY UNLOCK TO ALLOW ACCESS.
B. ANY ALARMS ASSOCIATED WITH THE OPENING OF THE DOOR WILL BE SHUNTED.
4. ONCE THE STRIKE TIME ON THE CARD READER HAS EXPIRED, THE DOOR SHALL RETURN TO A CLOSED AND LOCKED STATE.
5. WHEN AN OCCUPANT OPERATES THE INSIDE LEVER IN AN ATTEMPT TO EGRESS, THE FOLLOWING ACTIONS WILL OCCUR:
A. THE LATCHBOLT ON THE LOCKSET WILL MECHANICALLY RETRACT, ALLOWING THE OCCUPANT TO EGRESS THROUGH THE OPENING.
B. THE 'RX' SWITCH WILL CLOSE AND SHUNT ANY ALARMS ASSOCIATED WITH THE OPENING OF THE DOOR.
6. THE DOOR WILL REMAIN CLOSED AND LOCKED UPON LOSS OF POWER.

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Hardware Group No. 009
For use on Door #(s):
107C
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
8	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	MANUAL FLUSH BOLT	FB457 12" BOTTOM BOLT		626	IVE
1	EA	MANUAL FLUSH BOLT	FB457 24" TOP BOLT		626	IVE
1	EA	STOREROOM LOCK	L9080L 02A 1" STRIKE LIP LENGTH		626	SCH
1	EA	MORTISE CYLINDER	1080 A06		626	C-R
2	EA	OVERHEAD STOP	100S		630	GLY
2	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 010
For use on Door #(s):
107D
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	L9080L 02A		626	SCH
1	EA	MORTISE CYLINDER	1080 A06		626	C-R
1	EA	INTERCHANGEABLE CORE	8000		626	C-R
1	EA	DOOR CLOSER	4050A SCUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

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Hardware Group No. 011
For use on Door #(s):
107E
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
1	EA	CONT. HINGE	224HD EPT			313AN	IVE
1	EA	POWER TRANSFER	EPT10			695	VON
1	EA	ELEC PANIC HARDWARE	RX-98-EO-ALK 9-VOLT BATTERY WITH HARDWIRED OPTION			643E	VON
1	EA	MORTISE CYLINDER	1080 A02			613	C-R
1	EA	FINAL CORE	8000			606	C-R
1	EA	SURFACE CLOSER	4050A SCUSH			695	LCN
1	EA	RAIN DRIP	142D			D	ZER
1	EA	GASKETING	328D			D	ZER
1	EA	DOOR SWEEP	8198D			D	ZER
1	EA	THRESHOLD	655A-E			A	ZER
1	EA	POWER SUPPLY	PS902 900-BBK				VON
1	EA		RISER/ELEVATION DRAWING				
1	EA		POINT TO POINT DIAGRAM				

NOTES:
1. WIRE THE 'RX' SWITCH IN THE EXIT DEVICE TO THE ALARM KIT IN THE FOLLOWING MANNER:
A. CONNECT THE COMMON WIRE FROM THE 'RX' SWITCH TO THE 'RX/LX' TERMINAL.
B. CONNECT THE NORMALLY-OPEN WIRE FROM THE 'RX' SWITCH TO THE 'TB1' TERMINAL.
2. WIRE THE + TERMINAL ON THE PS902 TO THE + TERMINAL ON THE ALARM KIT'S CIRCUIT BOARD.
3. WIRE THE -- TERMINAL ON THE PS902 TO THE -- TERMINAL ON THE ALARM KIT'S CIRCUIT BOARD.

OPERATIONAL DESCRIPTION:
1. THE DOOR SHALL BE NORMALLY CLOSED AND SECURE.
2. FREE EGRESS IS DETERRED VIA THE ALARM KIT INSTALLED IN THE EXIT DEVICE.

EMERGENCY EGRESS:
1. THE GENERAL PUBLIC MAY EGRESS THROUGH THE OPENING IN THE EVENT OF AN EMERGENCY.
2. PUSHING ON THE TOUCHPAD OF EITHER EXIT DEVICE IN AN AN EMERGENCY WILL CAUSE THE FOLLOWING ACTIONS TO OCCUR:
A. THE LATCHBOLT ON THE EXIT DEVICE WILL RETRACT, UNLATCHING THE DOOR TO ALLOW ACCESS.
B. THE 'RX' SWITCH WILL CLOSE AND SUBSEQUENTLY ACTIVATE THE ALARM
3. THE ALARM WILL CONTINUE TO SOUND UNTIL IT IS RESET VIA THE KEY SWITCH.

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Hardware Group No. 012
For use on Door #(s):
108
Provide each UEP door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	224HD		313AN	IVE
1	SET	CONSTANT LATCHING FLUSH BOLTS	FB51P 24"		613	IVE
1	EA	DUST PROOF STRIKE	DP1		613	IVE
1	EA	STOREROOM LOCK	L9080L LLL 02LLL A L283-150 1" STRIKE LIP LENGTH		643e	SCH
1	EA	MORTISE CYLINDER	1080 A06		613	C-R
1	EA	FINAL CORE	8000		606	C-R
2	EA	DOOR CLOSER	4050A SHCUSH		695	LCN
1	EA	RAIN DRIP	142D		D	ZER
1	EA	GASKETING	328D		D	ZER
2	EA	DOOR SWEEP	8198D		D	ZER
1	EA	THRESHOLD	655A-E		A	ZER
2	EA	DOOR POSITION SWITCH	FURNISHED BY THE SECURITY CONTRACTOR.		BLK	B/O

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Hardware Group No. 013
For use on Door #(s):
112
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5			652	IVE
1	EA	POWER TRANSFER	EPT10			689	VON
1	EA	FACULTY RESTROOM/HOTEL W/ OUTSIDE INDICATOR W/ INSIDE INDICATOR	L9485L 02A L583-363 OS-OCC IS-OCC DM			626	SCH
1	EA	MORTISE CYLINDER	1080 A06			626	C-R
1	EA	INTERCHANGEABLE CORE	8000			626	C-R
1	EA	ELECTRIC STRIKE	6400 FSE 24VDC			US32D	VON
1	EA	OVERHEAD STOP	100S			630	GLY
1	EA	SURFACE CLOSER	4050A REG ST-5203			689	LCN
1	EA	MOUNTING PLATE	4050A-18			689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS			630	IVE
3	EA	SILENCER	SR64			GRY	IVE
1	EA	REMOTE RELEASE SYSTEM	FURNISHED BY THE SECURITY CONTRACTOR.				B/O
1	EA	RED/GREEN INDICATOR LIGHT	FURNISHED BY THE SECURITY CONTRACTOR.			WHT	B/O
1	EA	POWER SUPPLY	PS904 900-4RL 900-BBK				VON
1	EA		RISER/ELEVATION DRAWING				
1	EA		POINT TO POINT DIAGRAM				

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NOTES:
1. WIRE THE 8310-865 RF RECEIVER TO THE 900-4RL OPTION BOARD IN THE FOLLOWING MANNER:
A. CONNECT THE COMMON FROM THE RF RECEIVER TO THE 'SC' TERMINAL ON THE 900-4RL OPTION BOARD.
B. CONNECT THE NORMALLY-OPEN TERMINAL OF THE RF RECEIVER TO THE I1 TERMINAL OF THE 900-4RL OPTION BOARD.
2. WIRE THE ELECTRIC STRIKE TO THE 900-4RL OPTION BOARD IN THE FOLLOWING MANNER:
A. CONNECT THE FIRST WIRE FROM THE ELECTRIC STRIKE TO THE 'NO1' TERMINAL OF THE 900-4RL OPTION BOARD.
B. CONNECT THE SECOND WIRE FROM THE ELECTRIC STRIKE TO THE 'GND' TERMINAL OF THE 900-4RL OPTION BOARD.
3. THE DEADBOLT MONITOR SWITCH INSIDE THE MORTISE LOCK SHALLBE WIRED TO ENSURE THAT THE INDICATOR LIGHT CHANGES STATE WHEN THE DEADBOLT IS ENGAGED.
4. THE INDICATOR LIGHT ABOVE THE DOOR SHALL BE GREEN WHEN THE RESTROOM IS AVAILABLE.
5. THE INDICATOR LIGHT SHALL CHANGE TO RED WHEN AN OCCUPANT EXTENDS THE DEADBOLT TO SECURE THE OPENING.
6. SET THE RESPECTIVE 8310-865 RF RECEIVER TO A DIFFERENT CHANNEL/FREQUENCY.

OPERATIONAL DESCRIPTION:
1. THE DOOR SHALL BE NORMALLY CLOSED AND LOCKED.
2. FREE EGRESS SHALL ALWAYS BE POSSIBLE.
3. THE INDICATOR LIGHT ABOVE THE DOOR SHALL BE ILLUMINATED TO INFORM THE LIBRARY STAFF THAT THE RESTROOM IS NOT OCCUPIED.
4. WHEN A PATRON REQUESTS TO USE A RESTROOM, A STAFF MEMBER CAN PUSH THE APPROPRIATE BUTTON ON THE 8310-864 REMOTE SWITCH TO UNLOCK THE RESPECTIVE RESTROOM.
5. ONCE AN OCCUPANT IS INSIDE THE RESTROOM, THEY MAY EXTEND THE DEADBOLT TO LOCK THE DOOR.
6. EXTENDING THE DEADBOLT ON THE RESPECTIVE MORTISE LOCK WILL CAUSE THE FOLLOWING SIMULTANEOUS ACTIONS TO OCCUR:
A. THE INSIDE & OUTSIDE INDICATORS WILL CHANGE FROM "VACANT" TO "OCCUPIED".
B. THE INDICATOR LIGHT ABOVE THE DOOR WILL CHANGE FROM GREEN TO RED.
7. ONCE THE PATRON IS READY TO LEAVE THE RESTROOM, THEY MAY OPERATE THE INSIDE LEVER TO EGRESS.
8. OPERATING THE INSIDE LEVER WILL CAUSE THE FOLLOWING ACTIONS TO OCCUR:
A. THE LATCHBOLT AND DEADBOLT WILL SIMULTANEOUSLY RETRACT, UNLOCKING THE DOOR TO ALLOW THE OCCUPANT TO EGRESS.
B. THE INSIDE & OUTSIDE INDICATORS WILL CHANGE FROM "OCCUPIED" BACK TO "VACANT".
C. THE INDICATOR LIGHT ABOVE THE DOOR WILL CHANGE FROM RED BACK TO GREEN.

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Hardware Group No. 014
For use on Door #(s):
113 115
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5			652	IVE
1	EA	POWER TRANSFER	EPT10			689	VON
1	EA	FACULTY RESTROOM/HOTEL W/ OUTSIDE INDICATOR W/ INSIDE INDICATOR	L9485L 02A L583-363 OS-OCC IS-OCC DM			626	SCH
1	EA	MORTISE CYLINDER	1080 A06			626	C-R
1	EA	INTERCHANGEABLE CORE	8000			626	C-R
1	EA	ELECTRIC STRIKE	6400 FSE 24VDC			US32D	VON
1	EA	OVERHEAD STOP	100S			630	GLY
1	EA	SURFACE CLOSER	4050A REG ST-5203			689	LCN
1	EA	MOUNTING PLATE	4050A-18			689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS			630	IVE
1	EA	WALL STOP	WS401CCV			626	IVE
3	EA	SILENCER	SR64			GRY	IVE
1	EA	REMOTE RELEASE SYSTEM	FURNISHED BY THE SECURITY CONTRACTOR.				B/O
1	EA	RED/GREEN INDICATOR LIGHT	FURNISHED BY THE SECURITY CONTRACTOR.			WHT	B/O
1	EA	POWER SUPPLY	FURNISHED UNDER HARDWARE SET #013.			GRY	SCE
1	EA		RISER/ELEVATION DRAWING				
1	EA		POINT TO POINT DIAGRAM				

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NOTES:
1. WIRE THE 8310-865 RF RECEIVER TO THE 900-4RL OPTION BOARD IN THE FOLLOWING MANNER:
A. CONNECT THE COMMON FROM THE RF RECEIVER TO THE 'SC' TERMINAL ON THE 900-4RL OPTION BOARD.
B. CONNECT THE NORMALLY-OPEN TERMINAL OF THE RF RECEIVER TO THE I1 TERMINAL OF THE 900-4RL OPTION BOARD.
2. WIRE THE ELECTRIC STRIKE TO THE 900-4RL OPTION BOARD IN THE FOLLOWING MANNER:
A. CONNECT THE FIRST WIRE FROM THE ELECTRIC STRIKE TO THE 'NO1' TERMINAL OF THE 900-4RL OPTION BOARD.
B. CONNECT THE SECOND WIRE FROM THE ELECTRIC STRIKE TO THE 'GND' TERMINAL OF THE 900-4RL OPTION BOARD.
3. THE DEADBOLT MONITOR SWITCH INSIDE THE MORTISE LOCK SHALLBE WIRED TO ENSURE THAT THE INDICATOR LIGHT CHANGES STATE WHEN THE DEADBOLT IS ENGAGED.
4. THE INDICATOR LIGHT ABOVE THE DOOR SHALL BE GREEN WHEN THE RESTROOM IS AVAILABLE.
5. THE INDICATOR LIGHT SHALL CHANGE TO RED WHEN AN OCCUPANT EXTENDS THE DEADBOLT TO SECURE THE OPENING.
6. SET THE RESPECTIVE 8310-865 RF RECEIVER TO A DIFFERENT CHANNEL/FREQUENCY.

OPERATIONAL DESCRIPTION:
1. THE DOOR SHALL BE NORMALLY CLOSED AND LOCKED.
2. FREE EGRESS SHALL ALWAYS BE POSSIBLE.
3. THE INDICATOR LIGHT ABOVE THE DOOR SHALL BE ILLUMINATED TO INFORM THE LIBRARY STAFF THAT THE RESTROOM IS NOT OCCUPIED.
4. WHEN A PATRON REQUESTS TO USE A RESTROOM, A STAFF MEMBER CAN PUSH THE APPROPRIATE BUTTON ON THE 8310-864 REMOTE SWITCH TO UNLOCK THE RESPECTIVE RESTROOM.
5. ONCE AN OCCUPANT IS INSIDE THE RESTROOM, THEY MAY EXTEND THE DEADBOLT TO LOCK THE DOOR.
6. EXTENDING THE DEADBOLT ON THE RESPECTIVE MORTISE LOCK WILL CAUSE THE FOLLOWING SIMULTANEOUS ACTIONS TO OCCUR:
A. THE INSIDE & OUTSIDE INDICATORS WILL CHANGE FROM "VACANT" TO "OCCUPIED".
B. THE INDICATOR LIGHT ABOVE THE DOOR WILL CHANGE FROM GREEN TO RED.
7. ONCE THE PATRON IS READY TO LEAVE THE RESTROOM, THEY MAY OPERATE THE INSIDE LEVER TO EGRESS.
8. OPERATING THE INSIDE LEVER WILL CAUSE THE FOLLOWING ACTIONS TO OCCUR:
A. THE LATCHBOLT AND DEADBOLT WILL SIMULTANEOUSLY RETRACT, UNLOCKING THE DOOR TO ALLOW THE OCCUPANT TO EGRESS.
B. THE INSIDE & OUTSIDE INDICATORS WILL CHANGE FROM "OCCUPIED" BACK TO "VACANT".
C. THE INDICATOR LIGHT ABOVE THE DOOR WILL CHANGE FROM RED BACK TO GREEN.

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Hardware Group No. 015
For use on Door #(s):
117
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5			652	IVE
1	EA	POWER TRANSFER	EPT10			689	VON
1	EA	EU MORTISE LOCK	L9092LEU 02A RX LX CON 12/24 VDC			626	SCH
1	EA	MORTISE CYLINDER	1080 A06			626	C-R
1	EA	INTERCHANGEABLE CORE	8000			626	C-R
1	EA	OVERHEAD STOP	100S			630	GLY
1	EA	SURFACE CLOSER	4050A REG ST-5203			689	LCN
1	EA	MOUNTING PLATE	4050A-18			689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS			630	IVE
3	EA	SILENCER	SR64			GRY	IVE
1	EA	CARD READER	FURNISHED BY THE SECURITY CONTRACTOR.			BLK	B/O
1	EA	DOOR POS. SWITCH	679-05WD			BLK	SCE
1	EA	POWER SUPPLY	PS902 900-BBK				VON
1	EA		RISER/ELEVATION DRAWING				
1	EA		POINT TO POINT DIAGRAM				

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NOTES:
1. CONNECT THE DOOR POSITION SWITCH TO THE 'DPS' TERMINALS OF THE ACCESS CONTROL SYSTEM.
2. CONNECT THE 'RX' SWITCH INSIDE THE MORTISE LOCK TO THE 'RX' TERMINALS OF THE ACCESS CONTROL SYSTEM.

OPERATIONAL DESCRIPTION:
1. THE DOOR SHALL BE NORMALLY CLOSED AND LOCKED.
2. FREE EGRESS SHALL ALWAYS BE POSSIBLE.
3. PRESENTING A VALID CREDENTIAL TO THE CARD READER WILL CAUSE THE FOLLOWING ACTIONS TO OCCUR:
A. THE LEVER-HANDLE ON THE LOCKSET WILL ELECTRICALLY UNLOCK TO ALLOW ACCESS.
B. ANY ALARMS ASSOCIATED WITH THE OPENING OF THE DOOR WILL BE SHUNTED.
4. ONCE THE STRIKE TIME ON THE CARD READER HAS EXPIRED, THE DOOR SHALL RETURN TO A CLOSED AND LOCKED STATE.
5. WHEN AN OCCUPANT OPERATES THE INSIDE LEVER IN AN ATTEMPT TO EGRESS, THE FOLLOWING ACTIONS WILL OCCUR:
A. THE LATCHBOLT ON THE LOCKSET WILL MECHANICALLY RETRACT, ALLOWING THE OCCUPANT TO EGRESS THROUGH THE OPENING.
B. THE 'RX' SWITCH WILL CLOSE AND SHUNT ANY ALARMS ASSOCIATED WITH THE OPENING OF THE DOOR.
6. THE DOOR WILL REMAIN CLOSED AND LOCKED UPON LOSS OF POWER.

Hardware Group No. 016
For use on Door #(s):
118
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CORRIDOR LOCK W/ OUTSIDE INDICATOR	L9456L 02A L583-363 OS-OCC		626	SCH
1	EA	MORTISE CYLINDER	1080 A06		626	C-R
1	EA	INTERCHANGEABLE CORE	8000		626	C-R
1	EA	SURFACE CLOSER	4050A REG PULL-SIDE MOUNT		689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401CCV		626	IVE
1	EA	GASKETING	328AA-S		AA	ZER
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	DOOR BOTTOM	364AA		AA	ZER
1	EA	THRESHOLD	63A-223		A	ZER

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Hardware Group No. 017
For use on Door #(s):
120
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5			652	IVE
1	EA	POWER TRANSFER	EPT10			689	VON
1	EA	EU MORTISE LOCK	L9092LEU 02A RX LX CON 12/24 VDC			626	SCH
1	EA	MORTISE CYLINDER	1080 A06			626	C-R
1	EA	INTERCHANGEABLE CORE	8000			626	C-R
1	EA	SURFACE CLOSER	4050A REG			689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS			630	IVE
1	EA	WALL STOP	WS401CCV			626	IVE
1	EA	GASKETING	488SBK PSA			BK	ZER
1	EA	CARD READER	FURNISHED BY THE SECURITY CONTRACTOR.			BLK	B/O
1	EA	DOOR POSITION SWITCH	FURNISHED BY THE SECURITY CONTRACTOR.			BLK	B/O
1	EA	POWER SUPPLY	PS902 900-BBK				VON
1	EA		RISER/ELEVATION DRAWING				
1	EA		POINT TO POINT DIAGRAM				

NOTES:
1. CONNECT THE DOOR POSITION SWITCH TO THE 'DPS' TERMINALS OF THE ACCESS CONTROL SYSTEM.
2. CONNECT THE 'RX' SWITCH INSIDE THE MORTISE LOCK TO THE 'RX' TERMINALS OF THE ACCESS CONTROL SYSTEM.

OPERATIONAL DESCRIPTION:
1. THE DOOR SHALL BE NORMALLY CLOSED AND LOCKED.
2. FREE EGRESS SHALL ALWAYS BE POSSIBLE.
3. PRESENTING A VALID CREDENTIAL TO THE CARD READER WILL CAUSE THE FOLLOWING ACTIONS TO OCCUR:
A. THE LEVER-HANDLE ON THE LOCKSET WILL ELECTRICALLY UNLOCK TO ALLOW ACCESS.
B. ANY ALARMS ASSOCIATED WITH THE OPENING OF THE DOOR WILL BE SHUNTED.
4. ONCE THE STRIKE TIME ON THE CARD READER HAS EXPIRED, THE DOOR SHALL RETURN TO A CLOSED AND LOCKED STATE.
5. WHEN AN OCCUPANT OPERATES THE INSIDE LEVER IN AN ATTEMPT TO EGRESS, THE FOLLOWING ACTIONS WILL OCCUR:
A. THE LATCHBOLT ON THE LOCKSET WILL MECHANICALLY RETRACT, ALLOWING THE OCCUPANT TO EGRESS THROUGH THE OPENING.
B. THE 'RX' SWITCH WILL CLOSE AND SHUNT ANY ALARMS ASSOCIATED WITH THE OPENING OF THE DOOR.
6. THE DOOR WILL REMAIN CLOSED AND LOCKED UPON LOSS OF POWER.

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Hardware Group No. 018
For use on Door #(s):
123A
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	L9080L 02A		626	SCH
1	EA	MORTISE CYLINDER	1080 A06		626	C-R
1	EA	INTERCHANGEABLE CORE	8000		626	C-R
1	EA	OVERHEAD STOP	100S		630	GLY
3	EA	SILENCER	SR64		GRY	IVE

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Hardware Group No. 019
For use on Door #(s):
123
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5			652	IVE
1	EA	POWER TRANSFER	EPT10			689	VON
1	EA	EU MORTISE LOCK	L9092LEU 02A RX LX CON 12/24 VDC			626	SCH
1	EA	MORTISE CYLINDER	1080 A06			626	C-R
1	EA	INTERCHANGEABLE CORE	8000			626	C-R
1	EA	OVERHEAD STOP	100S			630	GLY
1	EA	SURFACE CLOSER	4050A REG ST-5203			689	LCN
1	EA	MOUNTING PLATE	4050A-18			689	LCN
1	EA	GASKETING	488SBK PSA			BK	ZER
1	EA	CARD READER	FURNISHED BY THE SECURITY CONTRACTOR.			BLK	B/O
1	EA	DOOR POSITION SWITCH	FURNISHED BY THE SECURITY CONTRACTOR.			BLK	B/O
1	EA	POWER SUPPLY	PS902 900-BBK				VON
1	EA		RISER/ELEVATION DRAWING				
1	EA		POINT TO POINT DIAGRAM				

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NOTES:
1. CONNECT THE DOOR POSITION SWITCH TO THE 'DPS' TERMINALS OF THE ACCESS CONTROL SYSTEM.
2. CONNECT THE 'RX' SWITCH INSIDE THE MORTISE LOCK TO THE 'RX' TERMINALS OF THE ACCESS CONTROL SYSTEM.

OPERATIONAL DESCRIPTION:
1. THE DOOR SHALL BE NORMALLY CLOSED AND LOCKED.
2. FREE EGRESS SHALL ALWAYS BE POSSIBLE.
3. PRESENTING A VALID CREDENTIAL TO THE CARD READER WILL CAUSE THE FOLLOWING ACTIONS TO OCCUR:
A. THE LEVER-HANDLE ON THE LOCKSET WILL ELECTRICALLY UNLOCK TO ALLOW ACCESS.
B. ANY ALARMS ASSOCIATED WITH THE OPENING OF THE DOOR WILL BE SHUNTED.
4. ONCE THE STRIKE TIME ON THE CARD READER HAS EXPIRED, THE DOOR SHALL RETURN TO A CLOSED AND LOCKED STATE.
5. WHEN AN OCCUPANT OPERATES THE INSIDE LEVER IN AN ATTEMPT TO EGRESS, THE FOLLOWING ACTIONS WILL OCCUR:
A. THE LATCHBOLT ON THE LOCKSET WILL MECHANICALLY RETRACT, ALLOWING THE OCCUPANT TO EGRESS THROUGH THE OPENING.
B. THE 'RX' SWITCH WILL CLOSE AND SHUNT ANY ALARMS ASSOCIATED WITH THE OPENING OF THE DOOR.
6. THE DOOR WILL REMAIN CLOSED AND LOCKED UPON LOSS OF POWER.

~~Hardware Group No. 020~~
~~For use on Door #(s):~~
~~M01~~
~~Provide each SGL door(s) with the following:~~

~~QTY~~		~~DESCRIPTION~~	~~CATALOG NUMBER~~		~~FINISH~~	~~MFR~~
~~1~~	~~EA~~	~~CONT. HINGE~~	~~224HD~~		~~313AN~~	~~IVE~~
~~1~~	~~EA~~	~~DBL CYL DEAD LOCK~~	~~L9462L.643E.643E~~		~~643E~~	~~SCH~~
~~1~~	~~EA~~	~~MORTISE CYLINDER~~	~~1080 A06~~		~~613~~	~~C-R~~
~~1~~	~~EA~~	~~FINAL CORE~~	~~8000~~		~~606~~	~~C-R~~
~~1~~	~~EA~~	~~FLUSH PULL~~	~~FURNISHED BY THE DOOR SUPPLIER~~		~~313AN~~	~~B/O~~
~~1~~	~~EA~~	~~OVERHEAD STOP~~	~~100S~~		~~613~~	~~GLY~~
~~1~~	~~EA~~	~~DOOR SEAL~~	~~FURNISHED UNDER SECTION 08_41_00.~~		~~AL~~	~~B/O~~
~~1~~	~~EA~~	~~DOOR SWEEP~~	~~8198D~~		~~D~~	~~ZER~~
~~1~~	~~EA~~	~~THRESHOLD~~	~~654A-E~~		~~A~~	~~ZER~~

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Hardware Group No. 021
For use on Door #(s):
123B
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
1	EA	CONT. HINGE	112HD EPT			313AN	IVE
1	EA	POWER TRANSFER	EPT10			695	VON
1	EA	ELEC PANIC HARDWARE	RX-35A-EO-ALK 9-VOLT BATTERY WITH HARDWIRED OPTION			643E	VON
1	EA	MORTISE CYLINDER	1080 A02			613	C-R
1	EA	FINAL CORE	8000			606	C-R
1	EA	DOOR CLOSER	4050A REG - (TOP JAMB MOUNT)			695	LCN
1	EA	MOUNTING PLATE	4050A-18G			695	LCN
1	EA	DOOR SEAL	FURNISHED UNDER SECTION 08_41_00.			AL	B/O
1	EA	DOOR SWEEP	8198D			D	ZER
1	EA	THRESHOLD	654A-E			A	ZER
1	EA	POWER SUPPLY	PS902 900-BBK				VON
1	EA		RISER/ELEVATION DRAWING				
1	EA		POINT TO POINT DIAGRAM				

NOTES:
1. WIRE THE 'RX' SWITCH IN THE EXIT DEVICE TO THE ALARM KIT IN THE FOLLOWING MANNER:
A. CONNECT THE COMMON WIRE FROM THE 'RX' SWITCH TO THE 'RX/LX' TERMINAL.
B. CONNECT THE NORMALLY-OPEN WIRE FROM THE 'RX' SWITCH TO THE 'TB1' TERMINAL.
2. WIRE THE + TERMINAL ON THE PS902 TO THE + TERMINAL ON THE ALARM KIT'S CIRCUIT BOARD.
3. WIRE THE -- TERMINAL ON THE PS902 TO THE -- TERMINAL ON THE ALARM KIT'S CIRCUIT BOARD.

OPERATIONAL DESCRIPTION:
1. THE DOOR SHALL BE NORMALLY CLOSED AND SECURE.
2. FREE EGRESS IS DETERRED VIA THE ALARM KIT INSTALLED IN THE EXIT DEVICE.

EMERGENCY EGRESS:
1. THE GENERAL PUBLIC MAY EGRESS THROUGH THE OPENING IN THE EVENT OF AN EMERGENCY.
2. PUSHING ON THE TOUCHPAD OF EITHER EXIT DEVICE IN AN EMERGENCY WILL CAUSE THE FOLLOWING ACTIONS TO OCCUR:
A. THE LATCHBOLT ON THE EXIT DEVICE WILL RETRACT, UNLATCHING THE DOOR TO ALLOW ACCESS.
B. THE 'RX' SWITCH WILL CLOSE AND SUBSEQUENTLY ACTIVATE THE ALARM
3. THE ALARM WILL CONTINUE TO SOUND UNTIL IT IS RESET VIA THE KEY SWITCH.

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Hardware Group No. 022
For use on Door #(s):
GATE-1 GATE-2
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	PANIC HARDWARE	LD-OUT-98-EO-4'-WH-SEC		626	VON
1	EA	NOTE	BALANCE OF HARDWARE BY THE GATE MANUFACTURER.			B/O

NOTE:
1. THE GATE MANUFACTURER SHALL PROVIDE A HEAVY-DUTY PLATE ON WHICH TO MOUNT THE EXIT DEVICE.
2. THE GATE MANUFACTURER SHALL PROVIDE A REINFORCED POST ON WHICH TO MOUNT THE ROLLER STRIKE FOR THE EXIT DEVICE.
3. THE REINFORCED POST SHALL BE LOCATED CLOSE ENOUGH IN PROXIMITY TO THE EXIT DEVICE CENTER CASE TO ENSURE PROPER LATCHING. (REFER TO THE EXIT DEVICE TEMPLATE FOR PROPER MOUNTING.)

Hardware Group No. 023
For use on Door #(s):
114
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	L9080L 02A		626	SCH
1	EA	MORTISE CYLINDER	1080 A06		626	C-R
1	EA	INTERCHANGEABLE CORE	8000		626	C-R
1	EA	SURFACE CLOSER	4050A EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401CCV		626	IVE
3	EA	SILENCER	SR64		GRY	IVE

END OF SECTION

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SECTION 08 80 00 - GLAZING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Insulating glass units.
   1. (IG-1) Insulating Vision - typical
   2. (IG-2) not used
   3. (IG-3) Insulating Vision - frit

B. Glazing units, for interiors.
   1. (GL-1) Sound control laminated

C. (GF-1, GF-2) Plastic films.

D. Laminated glass interlayers.

E. Glazing accessories.

1.2 RELATED REQUIREMENTS

A. Section 07 27 23 - Gypsum Sheathing Air Barriers.

B. Section 08 43 13 - Aluminum-Framed Entrances and Storefronts.

C. Section 08 44 13 - Glazed Aluminum Curtain Walls.

D. Section 10 28 00 - Toilet, Bath, and Laundry Accessories: Mirrors.

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. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).

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 C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021a.

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I. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

J. ASTM E413 - Classification for Rating Sound Insulation; 2022.

K. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2024.

L. GANA (GM) - GANA Glazing Manual; 2022.

M. GANA (SM) - GANA Sealant Manual; 2008.

N. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (Reaffirmed 2016).

O. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2023.

P. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2023.

Q. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2023.

R. NGA (LGRM) - Laminated Glazing Reference Manual; 2019.

S. OBC-2024 - 2024 Ohio Building Code; 2024.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data on insulating glass units, laminated glazing units, and plastic film. Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Samples: Submit two samples 12 by 12 inch in size of insulated glass units, laminated glass units, and plastic films, showing coloration and design.

E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with GANA (GM), GANA (SM), IGMA TM-3000, and NGA (LGRM) for glazing installation methods.

1.6 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

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1.7 WARRANTY

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

B. Insulating Glass Units: Provide a ten (10) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

C. Laminated Glass: Provide a ten (10) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Float Glass Manufacturers:

1. (Basis of Design) Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com.
2. Cardinal Glass Industries: www.cardinalcorp.com.
3. Guardian Glass, LLC: www.guardianglass.com.
4. Pilkington North America Inc: www.pilkington.com/en/us.
5. Saint Gobain North America: www.saint-gobain.com.

2.2 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.

1. Design Pressure: Calculated in accordance with ASCE 7 as required by OBC-2024.
2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.

B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier and air barrier.

1. In conjunction with weather barrier related materials described in other sections, as follows:
    a. Air Barriers: See Section 07 27 23.
2. To maintain a continuous air barrier throughout glazed assembly from glass pane to heel bead of glazing sealant.

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:

1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 7 computer program.

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2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 7 computer program.
3. Solar Optical Properties: Comply with NFRC 300 test method.

2.3 PERFORMANCE REQUIREMENTS - INTERIOR GLAZING ASSEMBLIES

A. Structural Performance: Glazing shall withstand design loads within limits and under conditions indicated as determined by OBC-2024 and ASTM E1300.

B. Maximum Deflection: For glazed partitions and interior storefronts.

1. For glass supported on all four edges, deflection normal to glazing plane is limited to 1/175 of clear span or 1/2 inch, whichever is smaller.
2. For butt-glazed panels, limit deflection for horizontal loading of 50 pounds per linear foot, applied at any point up to 42 inches a.f.f., to thickness of the panel or 1/2 inch, whichever is greater.

2.4 HAZARDOUS LOCATIONS

A. Provide safety glazing where indicated and where required by OBC-2024, Section 2406.4 Hazardous Locations.

1. Glazing in doors.
2. Glazing adjacent to doors.
3. Glazing units with all of the following attributes:
    a. The exposed area of an individual pane is greater than 9 square feet.
    b. The bottom edge of the glazing is less than 18 inches above the floor.
    c. The top edge of the glazing is greater than 36 inches above the floor.
    d. One or more walking surface(s) are within 36 inches, measured horizontally and in a straight line, of the plane of the glazing.
4. Glazing in guards and railings.
5. Glazing adjacent to wet surfaces.
6. Glazing adjacent to stairways and ramps.
7. Glazing adjacent to the bottom of a stair landing.

B. Identification of Safety Glazing: Label each pane with manufacturer's designation acid etched, ceramic fired, sand blasted, laser etched, embossed, or other permanent mark that specifies who applied the designation, the manufacturer or installer, manufacturer's name, type of glass, thickness, and the safety glazing standard with which it complies.

2.5 GLASS MATERIALS

A. Thicknesses: Glass thicknesses indicated are minimum; provide greater thickness as required to comply with performance requirements.

B. Float Glass: Provide float glass based glazing unless otherwise indicated.

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1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
2. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
    a. Fully Tempered Safety Glass: Complies with ANSI Z97.1 - Class A or 16 CFR 1201 - Category II criteria for safety glazing used in hazardous locations.

C. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class A or 16 CFR 1201 - Category II criteria for safety glazing used in hazardous locations.

2.6 INSULATING GLASS UNITS

A. Type IG-1 - Insulating Glass Units: Vision, with low-e coating.
1. Applications: Exterior insulating glass glazing unless otherwise indicated.
2. Space between lites filled with argon 90%, air 10%.
3. Total Thickness: 1 inch.
4. Thermal and Optical Performance:
    a. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.24, maximum.
    b. Visible Light Transmittance (VLT): 66 percent, nominal.
    c. Shading Coefficient (SC): 0.31, nominal.
    d. Solar Heat Gain Coefficient (SHGC): 0.27, nominal.
    e. Visible Light Reflectance, Outside: 13 percent, nominal.
5. Glazing Method: Dry glazing method, gasket glazing.
6. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
7. Metal Edge Spacers: Stainless steel, bent and spot welded corners.
8. Spacer Color: Black.
9. Edge Seal:
    a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone sealant as secondary seal applied around perimeter.
    b. Color: Black.
10. Purge interpane space with dry air, hermetically sealed.
11. Outboard Lite: 1/4 inch thick.
    a. Low-E Coating: Vitro Solarban 70 on #2 surface.
    b. Glass: Starphire (Ultra Clear Low-Iron).
        1) Typical: Annealed.
        2) Hazardous Locations: Fully tempered safety glazing.

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12. Inboard Lite: 1/4 inch thick.
    a. Coating: No coating on inboard lite.
    b. Glass: Starphire (Ultra Clear Low-Iron).
        1) Typical: Annealed.
        2) Hazardous Locations: Fully tempered safety glazing.

B. Type IG-2 - Not used

C. Type IG-3 - Insulating Glass Units - Vision with frit: Match IG-1 specification except for the following:
    1. Thermal and Optical Performance:
        a. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.24, maximum.
        b. Visible Light Transmittance (VLT): 35 percent, nominal.
        c. Shading Coefficient (SC): 0.27, nominal.
        d. Solar Heat Gain Coefficient (SHGC): 0.23, nominal.
        e. Visible Light Reflectance, Outside: 18 percent, nominal.
    2. Outboard Lite: Fully tempered float glass, 1/4 inch thick.
        a. Low-E Coating: Vitro Solarban 70 glass on #2 surface.
        b. Glass: Starphire (Ultra Clear Low-Iron).
    3. Inboard Lite: Fully tempered float glass, 1/4 inch thick.
        a. Glass: Starphire (Ultra Clear Low Iron).
        b. Opacifier: Ceramic frit, on #3 surface.
            1) Frit Color: Warm grey.
            2) Coating: 50% Dot pattern

D. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of another acceptable manufacturer.
    1. Substitution Procedures: See Section 01 60 00 - Product Requirements.
    2. For any product not identified as "Basis of Design", submit information as specified for substitutions.

2.7 GLAZING UNITS FOR INTERIORS

A. Type GL-1 - Sound Control Glazing: Laminated monolithic glass.
    1. Applications: Interior locations indicated on drawings.
    2. Sound Transmission Class (STC) Rating: Provide at least STC 37 rating, complying with ASTM E90 and ASTM E413.
    3. Overall Thickness: 3/8 inch, nominal.
    4. Laminated Monolithic Safety Glass:

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a. Outer Ply: Annealed glass, clear.
   1) Thickness: 3/16 inch.
b. Interlayer: Sound control acoustic polyvinyl butyral (PVB), thickness as specified.
c. Inner Ply: Annealed glass, clear.
   1) Thickness: 3/16 inch.

2.8 PLASTIC FILMS

A. Type GF-1, GF-2 - Decorative Plastic Film: Polyester type.
   1. Application: Locations as indicated on drawings.
   2. Pattern and Color: As indicated on drawings; Finish Selections/ A910.
   3. Thickness Without Liner: 0.002 inch.
   4. Products: As specified on drawings, manufactured by the following:
      a. Decorative Films, LLC, Skyline Design: www.decorativefilm.com.

2.9 LAMINATED GLASS INTERLAYERS

A. Sound Control Acoustic Polyvinyl Butyral (PVB) Interlayer:
   1. Functionality: Post-breakage safety and sound control.
   2. Applications:
      a. Single pane, laminated glass unit, Type GL-1.
   3. Color: Clear.
   4. Thickness: 0.030 inch, 30 mils, nominal.
   5. Improvement in Sound Transmission: Up to 3 dB, compared to standard PVB.
   6. Manufacturers:
      a. Eastman Chemical Company; Saflex Acoustic PVB Interlayer: www.saflex.com.
      b. Kuraray America, Inc; Trosifol Sound Control (SC) Monolayer: www.kuraray.us.com.
      c. Sekisui S-LEC America, LLC; S-LEC Sound Acoustic Film: www.s-lec.us.

2.10 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot 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. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

C. Butt-Joint Glazing Strips: Nominal 3mm thick, rigid plastic splines with pre-applied adhesive tape; sized for 3/8 inch thick glass.
   1. Applications: Vertical edge to edge butt-joint glazing at interior storefronts.

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2. Color: Clear
3. Products:
    a. C.R. Laurence Co; CRL Clear Copolymer Strips

PART 3 EXECUTION

3.1 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

C. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

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 glazing referenced standards.

3.4 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.5 INSTALLATION - BUTT JOINT GLAZING METHOD (CLEAR GASKETS)

A. Application: Interior glazing where indicated.

B. Comply with gasket manufacturer's written instructions.

C. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

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D. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

E. Install glazing gaskets at vertical, glass to glass, butt joints.

F. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.6 INSTALLATION - PRESSURE GLAZED SYSTEMS

A. Application - Exterior Glazed: Set glazing infills from exterior side of building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install pressure plates without displacing glazing gasket; exert pressure for full continuous contact.

E. Install cover plate.

3.7 INSTALLATION - STRUCTURAL SILICONE GLAZING

A. See Section 08 44 13 for structural silicone sealant and for curtain wall framing assembly requirements.

B. Application - Field Glazed: Follow basic guidelines of structural silicone glazing for glazing application.

1. Two-Sided Structural: Glass structurally adhered to vertical mullions with horizontal sides captured in glazing pockets.

C. Provide design review of the glazing system and project details, adhesion testing, proper surface preparation, training and a quality service program.

D. Provide only structural silicone sealant, tested and manufactured for structural glazing.

3.8 INSTALLATION - PLASTIC FILM

A. Confirm with Architect the correct glass surface for application; inboard or outboard.

B. Install plastic film with adhesive, applied in accordance with film manufacturer's instructions.

C. Place without air bubbles, creases or visible distortion.

D. Install film tight to perimeter of glass and carefully trim film with razor sharp knife. Provide 1/16 inch to 1/8 inch gap at perimeter of glazed panel unless otherwise required. Do not score the glass.

3.9 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.

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D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.10 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

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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.
4. Fluid-applied flooring finishes.

B. Removal of existing floor coverings.

C. Preparation of new and existing concrete floor slabs for installation of floor coverings.

D. Testing of new and existing concrete floor slabs for moisture and alkalinity (pH).

E. Testing of new and existing concrete floor slabs for flatness and levelness.

F. 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.

G. Patching compound.

H. Remediation of concrete floor slabs due to unsatisfactory flatness and levelness.

1. Contractor shall provide self-leveling underlayment to remediate non-compliant subfloors.

I. 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 C150/C150M - Standard Specification for Portland Cement; 2024.

C. ASTM C219 - Standard Terminology Relating to Hydraulic and Other Inorganic Cements; 2020a.

D. ASTM C348 - Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars; 2021.

E. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters, and Gypsum Concrete; 2020.

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F. ASTM E1155/E1155M - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers; 2023.

G. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

H. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.

I. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

J. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; 2018.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Visual Observation Report: For existing floor coverings to be removed.

C. 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.

D. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.

1. Manufacturer's qualification statement.
2. Certificate: Manufacturer's certification of compatibility with types of flooring applied over remedial product.
3. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.
4. Manufacturer's installation instructions.

E. Testing Agency's Report:

1. Description of areas tested; include floor plans and photographs if helpful.
2. Summary of conditions encountered.
3. Moisture and alkalinity (pH) test reports.
4. Flatness and levelness test reports.
5. Copies of specified test methods.
6. Recommendations for remediation of unsatisfactory surfaces.
7. Submit report directly to Owner.

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8. Submit report not more than two business days after conclusion of testing.

F. Adhesive Bond and Compatibility Test Report.

1.5 QUALITY ASSURANCE

A. Moisture and alkalinity (pH) testing and flatness/levelness testing will be performed by an independent testing agency employed and paid by Owner.

B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.

1. Submit evidence of experience consisting of at least 3 test reports of the type(s) required, with project Owner's project contact information.

C. Contractor's Responsibility Relating to Independent Agency Testing:

1. Provide access for and cooperate with testing agency.
2. Confirm date of start of testing at least 10 days prior to actual start.
3. Allow at least 4 business days on site for testing agency activities.
4. Achieve and maintain specified ambient conditions.
5. Notify Owner when specified ambient conditions have been achieved and when testing will start.

D. Remedial Coating Installer and Remedial Underlayment Installer Qualifications: Company or companies specializing in performing work of the type specified in this section, trained by or employed by remedial product manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing remedial moisture emission coatings or remedial flattening/leveling underlayments.

1.6 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.

1.7 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.

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1. Applications: For typical patching of minor irregularities in subfloor.
2. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
    a. 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.
    b. 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 XF: www.ardexamericas.com.
    b. Custom Building Products; SpeedFinish Patching & Finishing Compound: www.custombuildingproducts.com.
    c. H.B. Fuller Construction Products, Inc; TEC Feather Edge Skim Coat: www.tecspecialty.com.
    d. KOSTER American Corporation; KOSTER LevelStrong Skim Coat: www.kosterusa.com.
    e. LATICRETE International, Inc; SKIM LITE: www.laticrete.com.
    f. Maxxon Corporation; Maxxon Skim Fill: www.maxxon.com.
    g. Substitutions: See Section 01 60 00 - Product Requirements.

B. Hydraulic Cement Underlayment for Remedial Flattening/Leveling: Polymer-modified, blended hydraulic cement mix, that when mixed with water will produce a self-leveling underlayment, suitable for conditions, compatible with floor, floor covering, and floor covering adhesive.
1. Applications: For remediation of subfloors that fail to comply with specified minimum flatness and levelness.
2. Provide a product with the following characteristics:
    a. Cement Binder: ASTM C150/C150M, portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C219.
    b. Compressive Strength: Minimum 5000 pounds per square inch after 28 days, tested per ASTM C109/C109M.
    c. Flexural Strength: Minimum 1000 psi after 28 days, tested per ASTM C348.
    d. Thickness: Capable of thicknesses from feather edge to 1-1/2 inch, neat.
3. Products:
    a. (Basis of Design) ARDEX Americas; ARDEX K 15 with ARDEX P51 Primer: www.ardexamericas.com.
    b. Custom Building Products: www.custombuildingproducts.com.
    c. Dayton Superior Corporation: www.daytonsuperior.com.
    d. H.B. Fuller Construction Products, Inc: www.tecspecialty.com.
    e. Koster American Corporation: www.kosterusa.com.

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f. LATICRETE International, Inc: www.laticrete.com.

g. USG Corporation: www.usg.com.

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

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.

2. Products:

a. ARDEX Engineered Cements; ARDEX MC RAPID: www.ardexamericas.com.

b. Custom Building Products; TechMVC Moisture Vapor and Alkalinity Barrier: www.custombuildingproducts.com.

c. H.B. Fuller Construction Products, Inc; TEC LiquiDam Penetrating Moisture Vapor Barrier, 213: www.tecspecialty.com.

d. Koster American Corporation; KOSTER VAP I 2000 FS: www.kosterusa.com.

e. Maxxon Corporation; Maxxon MVP One Primer: www.maxxon.com.

f. Sika Corporation; Sikafloor Moisture Tolerance Epoxy Primer: usa.sika.com.

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

PART 3 EXECUTION

3.1 CONCRETE SLAB PREPARATION

A. Perform following operations in the order indicated:

1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:

a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.

b. Removal of existing floor covering.

2. Preliminary cleaning.

3. 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.

4. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.

5. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.

6. Specified remediation, if required.

7. Patching, smoothing, and leveling, as required.

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8. Other preparation specified.
9. Adhesive bond and compatibility test.
10. 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.
4. Out of True Subfloor: If subfloor fails to comply with specified minimum flatness and levelness minimum performance requirements, provide remedial flattening/leveling hydraulic cement underlayment product specified, and then re-test.

3.2 REMOVAL OF EXISTING FLOOR COVERINGS

A. Comply with local, State, and federal regulations and recommendations of RFCI (RWP), as applicable to floor covering being removed.

B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

3.3 PRELIMINARY CLEANING

A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.

B. Do not use solvents or other chemicals for cleaning.

3.4 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.

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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.

3.5 INTERNAL RELATIVE HUMIDITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F2170 Procedure A and as follows.

D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.

F. Report: Report the information required by the test method.

3.6 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. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.

1. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.

2. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.

C. 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.

3.7 FLATNESS AND LEVELNESS TESTING

A. Scope: Where new subfloors, including concrete slabs-on-ground and suspended slabs, identified in Contract Documents are receiving:

1. Large format thin-set ceramic tile and stone tile.

B. Test in accordance with ASTM E1155/E1155M.

C. Performance Requirements:

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1. Minimum Tolerances:
    a. Specified Overall Value (SOV) Flatness/Levelness (F_F/F_L): F_F35/F_L24.
    b. Minimum Local Value (MLV) Flatness/Levelness (F_F/F_L): F_F25/F_L17.

D. In the event that test values fail to comply with minimum performance requirements, provide hydraulic cement underlayment as indicated, and then re-test.

E. Report: Report the information required by the test method.

3.8 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.

3.9 ADHESIVE BOND AND COMPATIBILITY TESTING

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

3.10 APPLICATION OF REMEDIAL FLOOR COATING

A. Comply with requirements and recommendations of coating manufacturer.

3.11 INSTALLATION OF SELF-LEVELING UNDERLAYMENT

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

3.12 PROTECTION

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

END OF SECTION

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SECTION 09 21 16 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Non-load-bearing metal stud wall framing for interior partitions.

C. Suspension systems and metal channel framing for interior ceilings and soffits.

D. Acoustic insulation for sound-rated partitions.

E. Cementitious backing board.

F. Gypsum wallboard.

G. Joint treatment and accessories.

1.2 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Concealed wood blocking and nailers.

B. Section 07 27 23 - Gypsum Sheathing Air Barriers: Air-barrier-faced gypsum sheathing panels.

C. Section 07 54 00 - Thermoplastic Membrane Roofing: Glass-mat faced gypsum board roof deck sheathing and insulation cover board.

D. Section 07 92 00 - Joint Sealants: Products for sealing acoustical gaps in gypsum board construction.

1.3 DEFINITIONS

A. Interior Wet Areas: Include restrooms, kitchenettes, and janitor's closets.

1.4 REFERENCE STANDARDS

A. AISI S201 - North American Standard for Cold-Formed Steel Framing - Product Data; 2017.

B. AISI S202 - Code of Standard Practice for Cold-Formed Steel Structural Framing; 2020.

C. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.

D. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).

E. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2023.

F. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2024.

G. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2023.

H. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

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I. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2025.

J. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020 (Reapproved 2024).

K. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2023e.

L. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).

M. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2024.

N. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.

O. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

P. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2025.

Q. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.

R. 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.

S. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.

T. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units; 2025.

U. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2024.

V. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

W. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

X. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

Y. ASTM E413 - Classification for Rating Sound Insulation; 2022.

Z. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.

AA. GA-226 - Application of Gypsum Board to Form Curved Surfaces; 2025.

BB. GA-600 - Fire Resistance and Sound Control Design Manual; 2024.

CC. ICC-ES AC86 - Cold-formed Steel Framing Members - Interior Nonload-bearing Wall Assemblies; 2019, with Editorial Revision (2021).

DD. OBC-2024 - 2024 Ohio Building Code; 2024.

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EE. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2025.

FF. UL (FRD) - Fire Resistance Directory; Current Edition.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of gypsum board assemblies with size, location, and installation of service utilities.

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

C. Sequencing: Install service utilities in an orderly and expeditious manner.

1.6 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data:

1. Provide data on metal framing, gypsum board, decorative metal trim, joint finishing system, and accessories.

2. Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

C. Samples: Submit two samples of each type of decorative metal trim, 12 inches long, illustrating profile, finish color, and texture.

D. Equivalent (EQ) Framing Test Reports: For stud framing products that do not comply with ASTM C645 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections; test reports must show compliance with both of the following:

1. EQ framing is certified according to ICC-ES AC86.

2. EQ framing conforms to the limiting-height tables in ASTM C754.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

B. Store gypsum products and accessories indoors and keep above freezing. Elevate boards above floor, on nonwicking supports, in accordance with manufacturer's recommendations.

C. Stack gypsum board panels flat and supported on risers on a flat platform to prevent sagging.

D. Protect metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202.

E. Store metal products to prevent corrosion, under cover and above grade.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 or gypsum board manufacturer's written instructions, whichever are more stringent.

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B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install board products that are wet, moisture damaged, and mold damaged.

1. Water Damage Indications: Discoloration, sagging, or irregular shape.

2. Mold Damage Indications: Fuzzy or splotchy surface contamination and discoloration.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS - GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

1. See PART 3 for finishing requirements.

B. Horizontal Deflection: For non-composite walls, based on horizontal loading of 5 lbf/sq. ft comply with maximum deflection limits indicated.

1. Typical Painted Gypsum Board Walls: Not greater than 1/240 of the wall height.

2. Ceramic Tile: Not greater than 1/360 of the wall height.

C. Acoustic Assemblies: Provide completed assemblies with STC calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

1. See drawings for minimum acoustic attenuation requirements (STC).

D. Grid Suspension Systems: Provide grid suspension systems in accordance with ASTM C840 and GA-216

E. Fire-Resistance-Rated Assemblies: Provide completed assemblies, materials, and construction identical to those tested per ASTM E119, and with the following characteristics:

1. See drawings for hourly fire-resistance-ratings and basis of design UL listed assemblies.

2. Building Code Item Numbers: Comply with applicable requirements of OBC-2024 for the particular assembly.

3. Gypsum Association File Numbers: Comply with requirements of GA-600 for the particular assembly.

4. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

F. Ceramic Tile Support Assemblies: Provide framing members of size and properties necessary to comply with TCNA (HB) requirements, not less than 0.0329 inch (20-ga Structural) base-steel thickness, as defined by SSMA (TG).

2.2 METAL FRAMING MATERIALS

A. Material and Product Requirements Criteria: AISI S201.

B. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.

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C. Nonstructural Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing as specified in Performance Requirements.
   1. Minimum Base-Steel Thickness: As required to meet design criteria.
   2. Studs: C-shaped.
   3. Runners: U shaped, sized to match studs.
   4. Ceiling Channels: C- or T-shaped.
   5. Flexible Track: Flexible framing consisting of adjustable leg straps and pivoting, hinged track brackets designed to provide curved framing assemblies of varying radii in configurations indicated.
      a. Products:
         1) ClarkDietrich; 360TRAK: www.clarkdietrich.com.
         2) SCAFCO Perfect Curve: www.scafco.com.
   6. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch.
   7. Resilient Furring Channels: Single leg configuration; 1/2 inch channel depth.

D. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and screwed to secondary deflection channel set inside but unattached to top track.

E. Non-structural Framing Accessories:
   1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
   2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
      a. Materials: ASTM A36/A36M formed sheet steel support member with factory-welded ASTM A1003/A1003M steel plate base.
      b. Height: As indicated on drawings.
      c. Products:
         1) ClarkDietrich; Pony Wall Heavy (PW) or Pony Wall Lite (LGPW): www.clarkdietrich.com.
         2) Pittcon Industries; Knee Brace Kit (SKB): www.pittconindustries.com.
         3) SCAFCO Corporation; Ponywall: www.scafco.com.
         4) The Steel Network, Inc; MidWall: www.SteelNetwork.com.

F. Grid Suspension Systems: Steel grid system of main tees and support bars connected to structure using hanging wire.
   1. Available Products:
      a. Armstrong; Drywall Grid Solutions: www.armstrongceilings.com.
      b. CertainTeed; Drywall Suspension System: www.certainteed.com.

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c. USG Corporation; Drywall Suspension System: www.usg.com.

2.3 BOARD MATERIALS

A. Manufacturers - Source Limitations: Obtain each type of gypsum-based wallboard and joint finishing material from single source with resources to provide products of consistent quality in appearance and physical properties.

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, typical, unless otherwise indicated.
2. Moisture- and Mold-Resistant Type: Mold resistance score of 10, when tested in accordance with ASTM D3273.
    a. Moisture- and mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
    b. Moisture- and mold-resistant board is required at interior wet areas.
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. Abuse Resistant Wallboard:

1. Application: High-traffic areas indicated.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Type: Fire-resistance-rated Type X, UL or WH listed.
4. Thickness: 5/8 inch.
5. Edges: Tapered.

D. Tile Backing Board:

1. Application: Vertical surfaces behind ceramic wall tile in all locations.
2. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
    a. Thickness: 1/2 inch.

2.4 GYPSUM BOARD ACCESSORIES

A. Acoustic Insulation: ASTM C665; Flexible or semi-rigid preformed mineral-wool sound attenuation blankets, friction fit type, unfaced; thickness as required to fill stud cavity indicated, but not less than 3-1/2 inch.

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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. Formaldehyde Content: Zero.
4. Noise Reduction Coefficient (NRC): Not less than 1.05 at 3 inches thick, when tested in accordance with ASTM C423.
5. Products:
    a. Johns Manville; MinWool Sound Attenuation Fire Batts: www.jm.com.
    b. ROCKWOOL; AFB evo™: www.rockwool.com.
    c. Thermafiber, Inc; SAFB FF: www.thermafiber.com.
    d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant, as specified in Section 07 92 00; do not use solvent-based non-curing butyl sealant.

C. Finishing Accessories: ASTM C1047, extruded aluminum alloy (6063 T5), galvanized steel sheet ASTM A924/A924M G90, rolled zinc, or rigid plastic, unless noted otherwise.
1. Provide types as detailed or required for finished appearance; corner beads, control joint accessories, and other trim.
2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead, L-bead, LC-bead, and other shapes indicated on drawings at exposed panel edges.

D. Decorative Metal Trim:
1. Material: Extruded aluminum alloy 6063-T5 temper.
2. Finish: Factory primed for field painting.
3. Type(s): As specified on Drawings.
    a. Products:
        1) (Basis of Design) Fry Reglet Corporation; Drywall Profiles: www.fryreglet.com.
        2) Gordon Inc; TruForm Profiles: www.gordon-inc.com.
        3) Pittcon Industries; SOFTFORMS Drywall Reveals and Trims: www.pittconindustries.com.
        4) Tamlyn; XtremeInterior Architectural Solutions: www.tamlyn.com.
        5) Substitutions: See Section 01 60 00 - Product Requirements.

E. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
1. Applications:
    a. Interior Gypsum Board: Paper.
    b. Glass-Mat Gypsum Board: 10-by-10 glass mesh.
    c. Tile Backerboard: As recommended by backerboard manufacturer.

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2. Fiberglass Tape: 2 inch wide, coated glass fiber tape for joints and corners.
3. Paper Tape: 2 inch wide, creased paper tape for joints and corners.
4. Joint Compound for Interior Gypsum Board: Formulation that is compatible with other compounds applied on previous or for successive coats.
5. Joint Compound for Tile Backer: Formulation that is compatible with other compounds applied on previous or for successive coats.
    a. Water-Resistant Gypsum Backerboard:
        1) Taping: Use setting-type.
        2) Topping: Setting-type, sandable.
    b. Cementitious Backer Units: Use type recommended by panel manufacturer.
6. Joint Compound: Setting type, field-mixed.

F. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
    1. Basis of Design:
        a. CertainTeed Corporation; Level V Wall and Ceiling Primer/Surfacer with M2Tech: www.certainteed.com.
        b. PPG Paints; Speedhide MAXBUILD Interior High Build Drywall Surfacer: www.ppgpaints.com.
        c. USG Corporation; USG Sheetrock Brand Tuff-Hide Primer-Surfacer: www.usg.com.
        d. Substitutions: See Section 01 60 00 - Product Requirements.

G. Screws for Fastening of Gypsum Panel Products to Light Gauge Steel Framing Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

H. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

I. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

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

C. Examine gypsum drywall panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

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3.2 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C1007, AISI S220, and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.

1. Level ceiling system to a tolerance of 1/1200.

C. Studs: Space studs as needed to comply with performance requirements.

1. Extend partition framing to structure in all locations.

2. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Standard Wall Furring: Install at concrete and masonry 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.

1. Orientation: Vertical.

2. Spacing: As indicated.

F. Acoustic Furring: Install resilient channels at maximum 24 inches on center. Locate joints over framing members.

G. Blocking: Install wood blocking or mechanically fastened steel sheet or steel channel blocking for support of:

1. Framed openings.

2. Wall-mounted cabinets.

3. Plumbing fixtures.

4. Toilet partitions.

5. Toilet accessories.

6. Wall-mounted door hardware.

7. Other wall and ceiling mounted items indicated on drawings

3.3 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.

1. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions. Comply with ASTM C919 for closing off sound-flanking paths around or through assemblies.

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1. Place one bead continuously on substrate before installation of perimeter framing members.
2. Place continuous bead at perimeter of each layer of gypsum board.
3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes.

3.4 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

1. Exception: Tapered edges to receive joint treatment at right angles to framing.

C. Double-Layer, Nonrated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.

D. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

E. Tile Backing Board: Install where indicated, over steel framing members with not less than 0.0329 inch base metal thickness, in accordance with ANSI A108/A118/A136 and manufacturer's instructions.

1. For cementitious tile backer, install over steel framing members where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
2. Surface Alignment: Shim where required; align backerboard surface with adjoining gypsum wallboard surfaces.
3. Surface Flatness: Comply with TCNA (HB) for substrate flatness tolerance.

F. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.

G. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

3.5 INSTALLATION OF TRIM AND ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. 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.

C. Corner Beads: Install at external corners, using longest practical lengths.

D. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

E. Decorative Trim: Install at locations shown on drawings and in accordance with manufacturer's instructions.

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3.6 JOINT TREATMENT

A. Paper Faced Gypsum Board: Use paper joint tape, embed with setting type joint compound and finish with setting type joint compound.

3.7 FINISHING

A. Gypsum Board Finish Levels: Finish gypsum board in accordance with levels defined in ASTM C840, as follows:

1. Level 5: Wall and ceiling surfaces that will receive raking light; walls surfaces that extend more than one story; walls to receive semi-gloss or gloss paint finish, deep toned or dark colored paint finish, projector paint system; and other areas specifically indicated on drawings.
2. Level 4: Walls and ceilings to receive paint finish or wall coverings; this is the typical finish level for all surfaces, unless otherwise indicated.
3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
4. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction.

B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.

1. Feather coats of joint compound so that camber is maximum 1/32 inch.
2. Taping, filling, and sanding are not required at base layer of double-layer applications.

C. 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.

D. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.8 TOLERANCES

A. Typical Applications - Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction, unless indicated otherwise.

B. Tile Backing Board - Maximum Variation of Finished Backerboard Surface from True Flatness: As indicated in TCNA (HB).

1. Small Tile: Edges are shorter than 15 inches.
    a. 1/4 inch in 10 feet from the required plane.
    b. 1/16 inch in 12 inches when measured from high points in the surface.
2. Large Tile: At least one edge measures 15 inches, or greater.
    a. 1/8 inch in 10 feet from the required plane.
    b. 1/16 inch in 24 inches when measured from high points in the surface.

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3.9 PROTECTION

A. Protect installed gypsum board assemblies from subsequent construction operations.

END OF SECTION

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SECTION 09 30 00 - TILING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. (PCT-1) Tile for floor applications.

B. (PCT-2) Tile for wall applications.

C. Setting and grouting materials.

D. Metal trim.

1.2 DEFINITIONS

A. General: Definitions in ANSI A108/A118/A136 and ANSI A137.1 apply to Work of this Section, unless otherwise indicated.

B. Interior Wet Areas: Include restrooms and kitchenettes.

C. Large and Heavy Tile (LHT): Tile with at least one edge 15 inches or longer.

1.3 RELATED REQUIREMENTS

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

B. Section 09 21 16 - Gypsum Board Assemblies: For the following:

1. Backer board for wall surfaces behind wall tile.

2. Minimum base-steel thickness of framing supporting wall tile.

3. Flatness tolerances for substrates supporting wall tile.

4. Deflection limits of framed assemblies supporting wall tile.

1.4 REFERENCE STANDARDS

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2024.

B. ANSI A108.01 - General Requirements: Structures, Substrates, and Preparation of Tile; 2023.

C. ANSI A108.22 - Installation of Premixed Grout in Tilework; 2023.

D. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 2021.

E. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2023.

F. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2014 (Reaffirmed 2024).

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G. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2023.

H. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2022.

I. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2025.

J. TCNA (HB-GP) - Handbook for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs Installation; 2023.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, and setting details.

D. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.

2. Full-size units of each type of trim and accessory.

E. Installer's qualification statement.

F. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

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 Tile: 1 percent of each size, color, and surface finish combination, but not less than 10 square feet of each type.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Company specializing in performing tile installation, with minimum of five years of documented experience.

1.7 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. Setting and Grouting Materials:

1. ARDEX Engineered Cements: www.ardexamericas.com.

2. Bostik Inc: www.bostik.com.

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3. Custom Building Products: www.custombuildingproducts.com.
4. TEC Specialty Products LLC: www.tecspecialty.com.
5. LATICRETE International, Inc: www.laticrete.com.
6. Mapei Corporation: www.mapei.com.
7. Source Limitations:
    a. Furnish all products obtained from single supplier.
    b. Furnish each type of product produced by single manufacturer.
    c. Furnish underlayment from manufacturer of setting materials.
    d. Furnish crack isolation / waterproof membrane from manufacturer of setting materials.

2.2 TILE

A. PCT-1, PCT,-2:
1. Products: Provide products indicated on drawings; see Finish Selections/A910.
2. Substitutions: Not permitted.

2.3 TRIM AND ACCESSORIES

A. Metal Trim: Extruded aluminum; finish to be selected by Architect from manufacturer's full range; style, basis-of-design products and dimensions as indicated on drawings, for setting using tile mortar or adhesive.
1. Applications: As indicated on drawings.
    a. Open edges of wall and floor tile.
    b. Outside wall corners.
    c. Transition between floor finishes of different heights.
    d. Thresholds at door openings.
    e. Floor-to-wall joints.
2. Products:
    a. (Basis of Design) Schluter-Systems: www.schluter.com.
    b. Blanke Corporation: www.blankecorp.com.
    c. Genesis APS International: www.genesis-aps.com.
    d. Küberit USA, LLC: www.kuberitusa.com.
    e. LATICRETE International, Inc: www.laticrete.com.

2.4 SETTING MATERIALS

A. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.
1. Products:

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a. (Basis of Design) Custom Building Products; ProLite Premium Large Format Tile Mortar, with Multi-Surface Bonding Primer: www.custombuildingproducts.com.

2.5 GROUTS

A. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.

1. Applications: Toilet rooms.

2. Color(s): As indicated on drawings. If not indicated, as selected by Architect from manufacturer's full line.

3. Products:

a. (Basis of Design) Custom Building Products; CEG-IG 100% Solids Industrial Grade Epoxy Grout: www.custombuildingproducts.com.

2.6 MAINTENANCE MATERIALS

A. Tile Sealant: See Section 07 92 00.

2.7 ACCESSORY MATERIALS

A. Backing Board: See Section 09 21 16.

B. Concrete Floor Slab Crack Isolation / Waterproofing Membrane: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.

1. Crack Resistance: No failure at 1/8 inch gap, minimum; comply with ANSI A118.12.

2. Fluid or Trowel Applied Type:

a. Material: Synthetic rubber or Acrylic.

b. Products:

1) ARDEX Engineered Cements; ARDEX 8+9.

2) (Basis of Design) Custom Building Products; RedGard Crack Prevention and Waterproofing Membrane: www.custombuildingproducts.com.

3) TEC, an TEC/H.B. Fuller Construction Products Brand; TEC HydraFlex Waterproofing Crack Isolation Membrane.

4) LATICRETE International, Inc; LATICRETE HYDRO BAN.

5) Merkrete, by Parex USA, Inc; Merkrete Hydro Guard 2000.

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

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C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling 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 tiling material manufacturer and setting material manufacturer.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Vacuum clean surfaces and damp clean.

B. Seal substrate surface cracks with filler.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

D. Substrate Flatness:

1. For tile shorter than 15 inches, confirm that structure or substrate is limited to variation of 1/4 inch in 10 ft. from the required plane, and no more than 1/16 inch in 12 inches when measured from tile surface high points.

2. For large and heavy tile (LHT), tile with at least one edge 15 inches or longer, confirm that structure or substrate is limited to 1/8 inch in 10 ft. from the required plane, and no more than 1/16 inch in 24 inches when measured from tile surface high points.

3.3 INSTALLATION OF CERAMIC TILE SYSTEM - GENERAL

A. Install tile and grout in accordance with applicable requirements of ANSI A108.01 through ANSI A108.22, manufacturer's instructions, and TCNA (HB-GP) or TCNA (HB) 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 neatly. Align joints as indicated on drawings .

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 square.

F. Install metal trim in accordance with manufacturer's instructions.

G. Install thresholds where indicated on drawings.

H. Sound tile after setting. Replace hollow sounding units.

I. Keep control and expansion joints free of mortar, grout, and adhesive.

J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

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K. Grout tile joints unless otherwise indicated on drawings. Use standard grout unless otherwise indicated on drawings.

L. At changes 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.

1. See Section 07 92 00 for installation of sealant.

3.4 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F125-Full; improved latex-Portland cement bond coat over full coverage crack isolation membrane, with epoxy grout.

3.5 INSTALLATION - WALL TILE

A. Walls in Toilet Rooms: Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244C, using membrane at toilet rooms; thin-set with improved latex-Portland cement bond boat, with epoxy grout.

3.6 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, Clean tile and grout surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.

2. Clean grout smears and haze from tile in accordance with tile and grout manufacturer's written instructions.

3. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned.

4. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.7 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

1. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile surfaces.

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

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION

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SECTION 09 51 00 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. (ACT-1, ACT-2) Suspended metal grid and acoustic panel ceiling systems.

1.2 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 C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

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

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

1.3 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until 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 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning.

C. Product Data: Provide data on suspension system components and acoustical units.

D. Acoustic Panel Samples for Verification: Submit two full size samples illustrating material and finish of acoustical units.

E. Suspension Grid Samples: Submit two samples each, 12 inches long, of suspension system main runner and perimeter molding.

PART 2 PRODUCTS

2.1 ACOUSTICAL UNITS

A. (ACT-1, ACT-2) Acoustical Units - General: ASTM E1264, Class A.

1. Products: Provide products indicated on drawings; see Finish Selections/A910.

2. Substitutions: Not permitted.

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2.2 SUSPENSION SYSTEMS

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, clips, and splices as required.
   1. Materials:
      a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.

B. (ACT-1, ACT-2) Suspension System: Hot-dipped galvanized steel 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.
   4. Color: White.
   5. Products:
      a. Products: Provide products indicated on drawings; see Finish Selections/A910.
      b. Substitutions: Not permitted.

2.3 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, 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(s) and Profile(s): As required for installation conditions.

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. Install suspension system in accordance with ASTM C636/C636M and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

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C. Locate system on room axis according to reflected plan.

D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.

1. Use longest practical lengths.

E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

I. 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.

F. Where round obstructions occur, provide preformed closures to match perimeter molding.

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

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SECTION 09 65 00 - RESILIENT FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. (RES-1) Resilient tile flooring.

B. (WB-1, WB-2) Resilient base.

C. Resilient moldings, transition and edge strips.

D. Installation accessories.

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 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2025a.

B. ASTM F1344 - Standard Specification for Rubber Floor Tile; 2021a.

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

D. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

1.4 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 floor patterns.

D. Verification Samples: Submit two samples, 12 by 12 inch in size illustrating color and pattern for each resilient flooring product specified.

E. Installer's Qualification Statement.

F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing specified flooring with minimum five (5) years documented experience.

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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. (RES-1, RES-2) Rubber Tile: Homogeneous, color and pattern throughout thickness.

1. Minimum Requirements: Comply with ASTM F1344, of Class corresponding to type specified.
2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
3. Size: As indicated on drawings.
4. Total Thickness: 0.125 inch (3.5mm).
5. Seams: Chemically bonded using seam sealer.
6. Product(s), Color(s), and Pattern(s): As indicated on drawings; Finish Selections/A910.

2.2 RESILIENT BASE

A. (WB-1, WB-2) Resilient Base: ASTM F1861, Type TV, vinyl, thermoplastic; style as scheduled; see Finish Selections schedule on drawings.

1. Height(s): As indicated on drawings.
2. Thickness: 0.125 inch.
3. Finish: Satin.
4. Length: Roll.
5. Product(s) and Color(s): As indicated on drawings; Finish Selections/A910.

2.3 ACCESSORIES

A. Subfloor Levelling Compound: Specified in Section 09 05 61.

B. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.

C. Moldings, Transition and Edge Strips: Viny; products indicated on Drawings/A910.

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1. Products, Profiles, and Dimensions: Provide transitional moldings accessories in areas indicated on drawings.
2. Applications include, but are not limited to the following:
    a. Transition strips.
    b. Nosings for carpet or resilient floor covering.
    c. Reducer strips and joiners for carpet and resilient floor covering.
3. Color(s): As selected by Architect from manufacturer's full range.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are 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. Flatness and Levelness: Verify that subfloors are flat and level to tolerances acceptable to flooring manufacturer and as specified in Section 09 05 61; the more stringent shall govern.
    1. Test in accordance with Section 09 05 61.
    2. For out of tolerance subfloors, comply with remediation specified in Section 09 05 61.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
    1. Test in accordance with Section 09 05 61.
    2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
    3. Follow moisture and alkalinity remediation procedures in Section 09 05 61.

D. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

A. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

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. Spread only enough adhesive to permit installation of materials before initial set.
    2. Fit joints and butt seams tightly.
    3. Set flooring in place, press with heavy roller to attain full adhesion.

D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

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E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

1. Resilient Strips: Attach to substrate using adhesive.

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

3.4 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, in patterns indicated on drawings.

3.5 INSTALLATION - RESILIENT BASE

A. Do not stretch resilient base during installation.

B. Apply to walls, columns, pilasters; apply in toe spaces of casework, cabinets, lockers, and other permanent fixtures in rooms and areas where base is indicated.

C. Install in longest practical lengths with tops of adjacent pieces aligned. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

D. Miter or cope internal corners to minimize open joints. At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold without producing discoloration (whitening) at bends. At exposed ends, use premolded units.

1. Install premolded units before installing straight pieces.

2. Form corners with returns of not less than 6 inches in length

E. Install base on solid backing. Bond tightly to wall and floor surfaces in continuous contact throughout length of each piece.

F. Scribe and fit to door frames and other interruptions.

G. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

3.6 INSTALLATION - MOLDINGS, TRANSITION AND EDGE STRIPS

A. Butt to adjacent materials and tightly adhere to substrates throughout length of each piece.

B. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.7 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

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3.8 PROTECTION

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

END OF SECTION

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SECTION 09 67 00 - FLUID-APPLIED FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. (EPX-1) Epoxy flooring.

1.2 RELATED REQUIREMENTS

A. Section 03 35 11 - Concrete Floor Finishes: (SC) Clear sealer for finishing interior concrete floors in utilitarian applications.

B. Section 07 92 00 - Joint Sealants: Sealing joints between fluid-applied flooring and adjacent construction and fixtures.

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

D. Section 09 65 00 - Resilient Flooring: Applied wall base.

1.3 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; sizes, patterns and colors available.

C. Samples: Submit two samples, 12 by 12 inch in size illustrating color and pattern for each floor material for each color specified.

D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and application rate for each coat.

E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum Ten (10) years documented experience.

B. Applicator Qualifications: Company specializing in performing the work of this section.

1. Minimum Ten (10) years of documented experience.

2. Approved by manufacturer.

C. Supervisor Qualifications: Trained by product manufacturer , under direct full time supervision of manufacturer's own foreman.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resin materials in a dry, secure area.

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B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.6 FIELD CONDITIONS

A. Maintain minimum temperature in storage area of 55 degrees F.

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

C. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

PART 2 PRODUCTS

2.1 FLUID-APPLIED FLOORING SYSTEMS

A. (EPX-1) Fluid-Applied Flooring: Epoxy, without aggregate.

1. System Thickness: 15 mils, nominal, dry film thickness (DFT).
2. Texture: Orange peel.
3. Sheen: High gloss.
4. Color: As selected by Architect.
5. Products:
    a. Elite Crete Systems; E100-NV4 Novolac Protective Coating: www.elitecrete.com.
    b. Resinwerks; WBE 500 EP: www.resinwerks.com.
    c. Sherwin-Williams Company; Armorseal 100% Solids Epoxy: www.protective.sherwin-williams.com.
    d. Stonhard; Stonclad: www.stonhard.com.
    e. Westcoat Specialty Coating Systems; EPOXY MORTAR: www.westcoat.com.
    f. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 ACCESSORIES

A. Subfloor Filler: Type recommended by fluid-applied flooring manufacturer.

B. Primer: Type recommended by fluid-applied flooring manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.

B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.

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C. Cementitious Subfloor Surfaces: Verify that substrates are ready for fluid-applied 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 fluid-applied flooring manufacturer.
3. Follow moisture and alkalinity remediation procedures in Section 09 05 61.

3.2 PREPARATION

A. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.

B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind irregularities above the surface level. Prohibit traffic until filler is cured.

C. Vacuum clean substrate.

D. Apply primer to surfaces required by flooring manufacturer.

3.3 INSTALLATION - FLOORING

A. Apply in accordance with manufacturer's instructions.

B. Apply each coat to minimum thickness required by manufacturer.

C. Finish to smooth level surface.

3.4 PROTECTION

A. Prohibit traffic on floor finish for 48 hours after installation.

B. Barricade area to protect flooring until fully cured.

END OF SECTION

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SECTION 09 68 13 - TILE CARPETING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. (CPT-, CPT-2, CPT-3) Carpet tile, fully adhered.

1.2 RELATED REQUIREMENTS

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

B. Section 09 65 00 - Resilient Flooring: Resilient wall base and transition strips installed with carpet tile.

1.3 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2025a.

B. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

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; sizes, patterns, colors available, and method of installation.

C. Shop Drawings: Indicate layout of joints, layout of patterns, direction of carpet pile, and location of edge moldings.

D. Samples: Submit carpet tiles illustrating color and pattern design for each carpet color selected.

E. Installer's Qualification Statement.

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.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing carpet tile with minimum five (5) years documented experience and approved by carpet tile manufacturer.

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1.6 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.1 MATERIALS

A. (CPT-, CPT-2, CPT-3) Tile Carpeting:

1. Product(s): As indicated on drawings; Finish Selections/A910.
2. Nominal Tile Size: As indicated.
3. Thickness: As indicated.
4. Color: As indicated.
5. Pattern: As indicated.
6. Critical Radiant Flux: Not greater than 0.45 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.

2.2 ACCESSORIES

A. Subfloor Levelling Compound: Specified in Section 09 05 61.

B. Edge Strips: Vinyl, color as selected by Architect; see Section 09 65 00 - Resilient Flooring.

C. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

PART 3 EXECUTION

3.1 EXAMINATION

A. Flatness and Levelness: Verify that subfloor surfaces are smooth and flat within tolerances acceptable to flooring manufacturer and as specified in Section 09 05 61 for that type of work, he more stringent shall govern; and are ready to receive carpet tile.

1. Test in accordance with Section 09 05 61.
2. For out of tolerance subfloors, comply with remediation specified in Section 09 05 61.

B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).

1. Test in accordance with Section 09 05 61.
2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
3. Follow moisture and alkalinity remediation procedures in Section 09 05 61.

D. Verify that required floor-mounted utilities are in correct location.

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3.2 PREPARATION

A. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

3.3 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in pattern(s) indicated on drawings, with pile direction parallel to next unit.

F. Locate change of color or pattern between rooms under door centerline.

G. Fully adhere carpet tile to substrate.

H. Trim carpet tile neatly at walls and around interruptions.

I. Complete installation of edge strips, concealing exposed edges.

3.4 CLEANING

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

B. Remove excess adhesive without damage, from floor, base, and wall surfaces.

C. Clean and vacuum carpet surfaces.

END OF SECTION

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SECTION 09 69 33 - LOW-PROFILE FIXED HEIGHT ACCESS FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fixed height, low-profile access flooring system.

1.2 RELATED REQUIREMENTS

A. Section 09 68 13 - Tile Carpeting: Field applied finish for access flooring panels.

B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

C. Section 26 05 33.16 - Boxes for Electrical Systems.

D. Section 26 27 26 - Wiring Devices: Access floor boxes.

1.3 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

B. ASTM E2322 - Standard Test Method for Conducting Transverse and Concentrated Load Tests on Panels used in Floor and Roof Construction; 2022.

C. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. ICC-ES AC151 - Acceptance Criteria for Fixed-Height, Low-Profile, Raised Floor Systems; 2007.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 ADMINISTRATIVE REQUIREMENTS

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

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate floor layout, appurtenances or interruptions, edge details, and layout of underfloor utilities.

C. Samples: Submit one full-size sample of base unit, channel plate, and corner plate.

D. Certificate: Certify products meet or exceed specified requirements.

E. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention .

F. Project Record Documents: Indicate actual installed routing for services under access flooring and associated pathways utilized.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

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1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Extra Materials: Supply an additional two (2) percent of access flooring system components.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum ten (10) years of documented experience.

B. Installer Qualifications: Company specializing in performing the type of work required in this section and approved by access flooring manufacturer.

1.7 MOCK-UPS

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Construct mock-up of low-profile fixed height access flooring showing specified components, accessories, and finishes, and sized to include a minimum of two base units long by two base units wide.

C. Locate where indicated by Architect.

D. Accepted mock-up may remain as part of the work.

1.8 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 50 degrees F, and maximum relative humidity of 80 percent prior to, during, and after installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Access Flooring - Low-Profile Fixed Height:

1. FreeAxez; Gridd 70R: www.freeaxez.com.

2.2 PERFORMANCE REQUIREMENTS

A. General: Comply with the following system requirements and as indicated for specified components.

1. Comply with requirements of ICC-ES AC151.

B. Uniform Load: 100 psf, when tested in accordance with ASTM E2322.

1. Maximum Deflection: 0.15 inch.
2. Permanent Deformation: 0.06 inch maximum at design load.

C. Concentrated Load: Over an area of 1 inch by 1 inch, 200 pounds at any location, in compliance with ICC (IBC).

D. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 75, maximum; when tested in accordance with ASTM E84.

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2.3 FABRICATION

A. Tolerances:

1. Module Flatness: Plus or minus 0.02 inch measured diagonally on top of unit.
2. Module Width or Length From Specified Size: Plus or minus 0.015 inch.

2.4 ACCESS FLOORING - LOW-PROFILE FIXED HEIGHT

A. Access Flooring – Low-Profile Fixed Height: Factory-fabricated system consisting of fixed height base units forming a grid of cable trenches that are covered with removable steel floor plates; provide all components and accessories required for complete installation and as indicated.

1. Manufacturer's reinforced modular steel components.
2. System designed for installation without adhesives or fasteners.
3. System designed for integration with access flooring manufacturer's modular power distribution system.

B. Finished Floor Elevation: 2.75 inches nominal height above building structural floor.

C. Components:

1. Undersheet: Manufacturer's standard roll material.
2. Base Units:
   a. Provide interchangeable grommet base units in accordance with NFPA 70.
   b. Reinforced System: Standard base unit with integral support legs, reinforced corner, reinforced channel.
3. Floor Plate Panels: Galvanized steel plate of size and shape to cover trench spaces and to create uniform floor surface.
4. Module Size: 19.625 by 19.625 inches consisting of one base unit, two channel plates, and one corner plate.
5. Border Components: Manufacturer's standard components to infill gaps between the standard components and edges of field penetrations and boundary walls.

D. Floor Covering: Field applied, and as follows:

1. Carpet Tile: See Section 09 68 13.

2.5 ADAPTIVE CABLING DISTRIBUTION

A. Wiring Method: Field-installed branch circuit wiring. See Section 26 05 19.

B. Floor Box Service Outlets: See Section 26 27 26.

1. Provide standard listed and labeled outlets and wiring for power and communication signal services mounted flush with top of floor components.
2. Cover: Hinged steel with opening for passage of cables with cover closed.
   a. Maximum Concentrated Load: 300 lbf.

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b. Finish: As selected by Architect from manufacture's full range.

3. Box: Provide frame and steel box or formed-steel plate for mounting of receptacles and communication/signal jacks. Comply with Section 26 05 33.16.

4. Receptacles: See Section 26 27 26.

a. Type: Configuration as indicated on drawings.

5. Wiring Devices: See Section 26 27 26.

2.6 ACCESSORIES

A. Exposed Edge and Corner Trim: Manufacturer's standard stainless steel trim; install at locations where underfloor cavity is not enclosed by abutting walls or other construction.

B. Grommet Units: Base units with pass-through for power harnesses and communication cables.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify field measurements are as shown on shop drawings.

B. Verify substrates comply with minimum subfloor flatness (FF) of 25, and subfloor levelness (FL) of 20.

C. Verify that overhead ceiling work is complete, and wall surfaces have been painted with primer coat.

D. Verify that substrate is clean, dry, and free of deleterious material affecting access flooring installation.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Vacuum clean substrate surfaces.

3.3 INSTALLATION

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

B. Install undersheet with edges butted, without wrinkles, and contiguous throughout floor system work area.

C. Connect components without adhesive or mechanical fasteners.

D. Install system border components to provide a close fit with adjoining construction, with voids between 1/2 and 3/4 inch where panels abut vertical surfaces.

E. Exposed Edge and Corner Trim: Install at locations indicated on shop drawings and as required by field conditions.

1. Install edge trim at exposed sides.

F. Secure ramps to concrete subfloor using manufacturer's recommended anchors.

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3.4 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Provide manufacturer's field representative to inspect components, assemblies, flooring installation, and connections.

3.5 CLOSEOUT ACTIVITIES

A. See Section 01 79 00 - Demonstration and Training, for additional requirements.

B. Training: Train Owner's maintenance personnel to adjust, operate, and maintain access flooring system.

3.6 PROTECTION

A. Protect installed access flooring system from damage due to subsequent construction until Date of Substantial Completion.

END OF SECTION

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SECTION 09 72 00 - WALL COVERINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. (WC-1, WC-2) Wall coverings.

1.2 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting: Substrate preparation.

1.3 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

B. ASTM F793/F793M - Standard Classification of Wall Coverings and Ceiling Coverings by Use Characteristics; 2025.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets for wall covering and adhesive. Indicate compliance with specified flame spread and smoke developed ratings.

C. Shop Drawings: Show location and extent of each wall-covering type. Indicate wall elevations with pattern placement.

D. Samples: Submit two samples of wall covering, 12 by 12 inch in size illustrating color, finish, and texture.

E. Maintenance Materials: Furnish the following for Owner's use in project maintenance:

1. See Section 01 60 00 - Product Requirements for additional provisions.
2. Extra Stock Materials: 25 feet of each color and pattern of wall covering.
    a. Package and label each roll by manufacturer, color, pattern, and destination room number.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least five (5) years of documented experience and approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inspect roll materials for damage upon arrival.

B. Protect packaged adhesive from temperature and humidity cycling and cold temperatures.

C. Do not store roll goods on end.

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1.7 FIELD CONDITIONS

A. Maintain these conditions 96 hours before, during, and 96 hours after installation of adhesive and wall covering.

B. Provide lighting level of 80 fc measured mid-height at substrate surfaces.

1.8 WARRANTY

A. Manufacturer written warranty against defects in workmanship for 5 years from date of installation.

PART 2 PRODUCTS

2.1 WALL COVERINGS

A. Performance Requirements:

1. Surface Burning Characteristics: Flame spread index of 75 , maximum, and smoke developed index of 50, maximum, when tested in accordance with ASTM E84.

B. (WC-1, WC-2) Wall Covering: Fabric-backed vinyl roll stock.

1. Comply with ASTM F793/F793M.

2. Products: As scheduled on Drawings.

2.2 ACCESSORIES

A. Adhesive: Type recommended by wall covering manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify substrate surfaces are primed and meet manufacturer's requirements to receive work.

B. Measure moisture content of substrates with electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.

C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet or at rate greater than 1/16 inch/ft.

D. Notify Architect of detrimental conditions affecting wall covering installation.

E. Correct detrimental conditions before starting installation.

3.2 PREPARATION

A. Remove wall plates and accessories impeding wall covering installation.

B. Substrate Priming and Preparation: See Section 09 91 23.

C. Prepare surfaces in accordance with manufacturer's written instructions.

D. Wash impervious surfaces with tetra-sodium phosphate; rinse and neutralize; wipe dry.

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E. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings before preparing surfaces or finishing.

F. Vacuum surfaces to remove loose particles.

3.3 INSTALLATION

A. Apply adhesive and wall covering in accordance with manufacturer's instructions.

B. Apply adhesive to wall immediately before applying wall covering.

C. Use wall covering in roll number sequence.

D. Razor trim edges of wall covering. Do not razor trim on gypsum board surfaces.

E. Smoothly apply wall covering without wrinkles, gaps, or overlaps. Eliminate air pockets and ensure full bond to substrate surface.

F. Horizontal seams are not permitted.

G. Do not seam within 2 inches of internal corners or within 6 inches of external corners.

H. Install wall covering before installing bases and items attached to, abutting, or located within 1 inch of wall surface.

I. Do not install wall covering more than 1/4 inch below top of resilient base.

J. Cover spaces above and below windows and above doors in pattern sequence from roll.

K. Where wall covering tucks into reveals, metal wallboard, or plaster stops, use contact adhesive within 6 inches of wall covering termination. Ensure complete contact bond.

L. Remove excess adhesive from seams while wet and before proceeding to next wall covering sheet.

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

3.4 CLEANING

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

B. Clean wall coverings of dust, dirt, excess adhesive, and other contaminants.

3.5 PROTECTION

A. Protect installed products from damage until date .

END OF SECTION

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SECTION 09 84 33 - SOUND-ABSORBING WALL UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. (PNL-1, PNL-2) Sound-absorbing panels.

1.2 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

1.3 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Shop Drawings: Fabrication and installation details, panel layout and fabric orientation.

D. Verification Samples: Fabricated samples of each type of panel specified; 12 by 12 inch, showing construction, edge details, and fabric covering.

E. Test Reports: Certified test data from an independent test agency verifying that panels meet specified requirements for acoustical and fire performance.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect acoustical units from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until units are needed for installation.

B. Store units flat, in dry, well-ventilated space; do not stand on end.

C. Protect edges from damage.

PART 2 PRODUCTS

2.1 FABRIC-COVERED SOUND-ABSORBING UNITS

A. Manufacturers:

1. (Basis of Design) Conwed: www.conwed.com.
2. Essi Acoustical Products Company: www.essiacoustical.com.
3. MBI: www.mbiproducts.com.
4. Warwick Products/MPC: www.mpcsilentwall.com.
5. Working Walls Solutions, Inc: www.workingwalls.com.

B. General:

1. Prefinished, factory assembled fabric-covered panels.

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2. Surface Burning Characteristics: Flame spread index of 75 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.

C. (PNL-1, PNL-2) Fabric-Covered Acoustical Panels for Walls:

1. Products:

a. Provide products indicated on drawings; Finish Selections/A910.

2. Panel Core: Manufacturer's standard rigid or semi-rigid fiberglass core.

3. Panel Size and Thickness: As indicated on drawings.

4. Edges: Perimeter edges reinforced by a formulated resin hardener.

5. Corners: Square.

6. Fabric: As indicated on drawings.

7. Patterns: Where fabric with directional or repeating patterns or fabric with directional weave is used, mark for installation in same direction.

8. Mounting Method: Back-mounted with Z-clip or Z-bar mechanical fasteners.

2.2 FABRICATION

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

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

2.3 ACCESSORIES

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

1. Two-part clip and base-support bracket system; brackets designed to support full weight of panels and clips designed for lateral support, with one part mechanically attached to back of panel and the other attached to substrate.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

A. Install acoustical units in locations as indicated, following manufacturer's installation instructions.

B. Install mounting accessories and supports in accordance with shop drawings.

C. Align panels accurately, with edges plumb and top edges level.

D. Install acoustical units to construction tolerances of plus or minus 1/16 inch for the following:

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1. Plumb and level.
2. Flatness.

3.3 CLEANING

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

3.4 PROTECTION

A. Provide protection of installed acoustical panels until Date of Substantial Completion.

B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

END OF SECTION

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SECTION 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. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.

2. Mechanical and Electrical:

a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, electrical equipment, fully factory-finished panelboards, and fully factory-finished switch gear, unless otherwise indicated.

b. In all areas, paint shop-primed items.

c. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.

d. Paint dampers exposed behind louvers, grilles, to match face panels.

D. Do Not Paint or Finish the Following Items:

1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.

2. Items indicated to receive other finishes.

3. Items indicated to remain unfinished.

4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.

5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.

6. Marble, granite, slate, and other natural stones.

7. Floors, unless specifically indicated.

8. Ceramic and other tiles.

9. Brick, architectural concrete, cast stone, integrally colored plaster, and stucco.

10. Glass.

11. Acoustical materials, unless specifically indicated.

12. Concealed pipes, ducts, and conduits.

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1.2 RELATED REQUIREMENTS

A. Section 09 91 13 - Exterior Painting.

1.3 REFERENCE STANDARDS

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

1.4 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. Product List: Cross-reference to specified paint system products to be used in project; include description of each system and locations of application area for each paint system.

a. Use same designations indicated on Drawings and in schedules.

b. Include color designations.

c. Include itemized list of fully factory-finished items visible in finished spaces that are indicated to be field painted.

3. Manufacturer's installation instructions.

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.

D. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, and color samples of each color and finish used.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.

2. Extra Paint and Finish Materials: 1 gal of each color; from the same product run, store where directed.

3. Label each container with color in addition to the manufacturer's label.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five (5) years documented experience.

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1.6 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.

1.7 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. Base Manufacturer: Benjamin Moore & Co: www.benjaminmoore.com.

2. PPG Paints: www.ppgpaints.com.

3. Sherwin-Williams Company: www.sherwin-williams.com.

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

2.2 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.

1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.

2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

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3. Supply each paint material in quantity required to complete entire project's work from a single production run.
4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Colors: As indicated on drawings; see Finish Selections/A910.
1. Extend colors to surface edges; colors may change at any edge as directed by Architect.
2. In finished areas, finish pipes, ducts, conduit, access panels, and equipment the same color as the wall/ceiling under which they are mounted.

2.3 PAINT SYSTEMS - INTERIOR

A. Drywall:
1. Primer: Benjamin Moore; Ultra Spec 500 Interior Latex Primer (N534)
2. Finish: 2 coats Benjamin Moore; Ultra Spec SCUFF-X Interior
a. Ceilings: Matte (N484)
b. Walls: Eggshell (C485)

B. Rough or Pitted Masonry:
1. Primer: Benjamin Moore; Ultra Spec Masonry Interior/Exterior Hi-Build Block Filler (571)
2. Finish: 2 coats Benjamin Moore; Ultra Spec SCUFF-X Interior
a. Walls: Eggshell (C485)

C. Smooth Poured or Precast Concrete:
1. Primer: Benjamin Moore; Ultra Spec Masonry Interior / Exterior 100% Acrylic Masonry Sealer (608)
2. Finish: 2 coats Benjamin Moore; Ultra Spec SCUFF-X Interior
a. Walls: Eggshell (C485)

D. Ferrous Metal (Steel and Iron):
1. Primer: Benjamin Moore; Ultra Spec HP Acrylic Metal Primer (HP04) or Super Spec HP Alkyd Metal Primer (P06)
2. Finish: 2 coats Benjamin Moore; Ultra Spec SCUFF-X Interior
a. Ceilings: Matte (N484)
b. Walls: Eggshell (C485)
c. Doors, Frames, and Other High-Touch Surfaces: Semi-Gloss (N487)

E. Non-Ferrous Metal (Galvanized & Aluminum):
1. Primer: Benjamin Moore; Ultra Spec HP Acrylic Metal Primer (HP04)
2. Finish: 2 coats Benjamin Moore; Ultra Spec SCUFF-X Interior
a. Ceilings: Matte (N484)

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b. Walls: Eggshell (C485)

c. Doors, Frames, and Other High-Touch Surfaces: Semi-Gloss (N487)

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 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. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

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 or repair existing paints or finishes that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

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.

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2. Clean vertical and overhead surfaces with pressurized water. Use pressure range of 1,500 to 4,000 psi at 6 to 12 inches. Allow to dry.
3. Prepare floor surface as recommended by top coat manufacturer and according to SSPC-SP 13.

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. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

J. 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.

K. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

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.

C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

G. Sand wood and metal surfaces lightly between coats to achieve required finish.

H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 CLEANING

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

3.5 PROTECTION

A. Protect finishes until completion of project.

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B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

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SECTION 10 11 00 - VISUAL DISPLAY UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Porcelain enamel steel markerboards.

B. Art rail cable display systems.

1.2 REFERENCE STANDARDS

A. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling; 2025.

B. ASTM A555/A555M - Standard Specification for General Requirements for Stainless Steel Wire and Wire Rods; 2023.

C. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

1.3 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data on markerboard, trim, and art rail system.

C. Shop Drawings: Indicate wall elevations, dimensions, joint locations, special anchor details.

D. Samples: Submit two samples 2 by 2 inch in size illustrating materials and finish, color and texture of markerboard, tackboard, trim, and cable display system.

E. Maintenance Data: Include data on regular cleaning, stain removal .

PART 2 PRODUCTS

2.1 VISUAL DISPLAY UNITS

A. Porcelain Enamel Steel Markerboards:

1. Manufacturers:

a. (Basis of Design) Egan Visual Corporation: www.egan.com.

b. ADP Lemco, Inc: www.adplemco.com.

c. AJW Architectural Products: www.ajw.com.

d. ASI Visual Display Products: www.asi-visualdisplayproducts.com.

e. Claridge Products and Equipment, Inc: www.claridgeproducts.com.

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f. MooreCo Inc: www.moorecoinc.com.

g. Nelson Adams NACO: www.nelsonadamsnaco.com.

h. Polyvision Corporation: www.polyvision.com.

2. Color: White.

3. Porcelain Enameled Steel Sheet: ASTM A424/A424M, Type I, Commercial Steel, with fired-on vitreous finish.

a. Steel Face Sheet Thickness: 24 gauge, 0.0239 inch .

4. Core: Particleboard, manufacturer's standard thickness, laminated to face sheet.

5. Backing: Aluminum foil, laminated to core.

6. Size: As indicated on drawings.

7. Frame: Extruded aluminum, with concealed fasteners.

8. Frame Profile: Narrow.

9. Frame Finish: As selected by Architect from manufacturer's full range.

10. Basis of Design Product:

a. Egan Visual Corporation; Egan Visual WhiteBoards.

B. Art Rail Cable Display Systems:

1. Manufacturers:

a. (Basis of Design) AS Hanging Display Systems, Inc: www.ashanging.com.

1) Wall Track: Model A1004

2) Hanging Cable: C-End Cable, C2010, with Secure Gripper Hook H3002

b. Arakawa Hanging Systems: www.arakawagrip.com.

c. Nova Display Systems, Inc: www.novadisplay.com.

2. Suspended cable display system used to support artwork from walls. Sizes and configurations indicated on drawings.

a. Wire Cable: 7x7 construction.

1) Stainless Steel: ASTM A555/A555M; ASTM A666/A666M, Type 304.

2) Size: 1/16-inch diameter.

3) Cable End: C-End fitting.

b. Tracks: Extruded aluminum, open face.

1) Aluminum Extrusions: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

2) Finish: Baked enamel or powder coated; white.

3) End Caps: Match finish of extrusion.

c. Cable Gripper Fittings: Provide Black plastic multiposition supports.

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PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

C. Verify flat wall surface for adhesive-applied boards.

3.2 PREPARATION

A. Acclimatize tackable wall panels by removing from packaging in installation area not less than 24 hours before application.

B. Remove switchplates, wall plates, and surface-mounted fixtures where tackable wall paneling is applied. Reinstall items on completion of installation.

C. 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. Install boards in accordance with manufacturer's instructions.

B. Secure units level and plumb.

C. Butt Joints: Install with tight hairline joints.

D. Install tackable wall panels in accordance with manufacturer's recommendations on specified substrates with concealed attachments.

3.4 CLEANING

A. Clean board surfaces in accordance with manufacturer's instructions.

B. Remove temporary protective cover at Date of Substantial Completion.

END OF SECTION

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SECTION 10 11 43 - VISUAL DISPLAY WALL PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. (PNL-3) Wood slatwall display units.

B. (PNL-4) Steel slatwall display units.

1.2 RELATED REQUIREMENTS

A. Appendix Item 02; Cleveland Public Library Experiential Branding Standards, Moody Nolan.

B. Section 06 10 53 - Miscellaneous Rough Carpentry: Blocking and supports.

1.3 REFERENCE STANDARDS

A. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications; 2022.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data on slatwall panels, trim, and accessories.

C. Shop Drawings: Include plans, sections, details, and attachments to other work. Detail fabrication and installation, including field joints.

D. Selection Samples: Color charts for selection of color and finish.

E. Samples: Submit 6 by 10 inch panel for each material, color and finish specified.

PART 2 PRODUCTS

2.1 VISUAL DISPLAY UNITS

A. (PNL-3) Wood Slatwall Display Panels:

1. Manufacturers:

a. Marlite, Inc; Slatwall Digitally-Printed, Low-Pressure Melamine (LPM): www.marlite.com.

2. Panels: 3/4 inch thick with nominal 1/2 inch deep slotted groves at 4 inches o.c.

a. MDF Core: Medium density wood fiberboard complying with ANSI A208.2.

3. Finish: Low pressure laminate, melamine treated paper, bonded to MDF substrate.

a. Color and Pattern: As indicated on drawings; Finish Selections/A910.

b. Custom Digital Printing: Signage as indicated in Appendix Item 02, "Community Wall Collateral Display."

4. Grove Inserts:

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a. Plastic; color as selected by Architect.

1) Product:

(a) Marlite, Inc; Marlite Vinyl Color Snaps 2000 Series: www.marlite.com.

5. Trim: Manufacturer's standard profiles.

a. Plastic; color as selected by Architect.

B. (PNL-4) Steel Slatwall Display Panels:

1. Panels: 20 gauge (0.0359 inch) steel; 3/4 inch deep slats, at 3 inches o.c. Overall size and configuration indicated on drawings.

2. Finish: Baked enamel; color as selected by Architect.

3. Manufacturers:

a. Megawall, Inc: www.megawall.com.

b. NewAge Products Inc; Bold Series Slatwall Backsplash: www.megawall.com.

c. Wind Mill Slatwall Products, a division of Amerhart; Steel Slatwall: www.windmillslatwall.com.

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

2.2 ACCESSORIES

A. Commercial Display Hardware:

1. Wire Hook for Slatwall: 12 inches long by 1/4 inch diameter wire hook with backplate sized for mounting in standard slatwall grooves; chrome finish.

a. Basis of Design: Richelieu Inc; Model 9281412140.

2. Adjustable Bracket for Wood Shelf: 14 inch long bracket, adjustable to five angled positions; with backplate sized for mounting in standard slatwall grooves; chrome finish.

a. Basis of Design: Richelieu Inc; Model 92813142G.

B. Clear Acrylic Display Holders: Provide products specified in Appendix Item 02, "Community Wall Collateral Display."

1. Manufacturers:

a. Displays2Go: www.displays2go.com.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated on shop drawings.

B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

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3.2 PREPARATION

A. Conditioning: Acclimatize wood slatwall panels by removing from packaging in installation area not less than 72 hours before application.

3.3 INSTALLATION

A. Install slatwall display panels and accessories in accordance with manufacturer's instructions.

B. Secure units level and plumb; with tight hairline joints.

C. Carefully cut holes in boards for thermostats and wall switches.

3.4 CLEANING

A. Clean panel surfaces in accordance with manufacturer's instructions.

END OF SECTION

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SECTION 10 14 19 - DIMENSIONAL LETTER SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Dimensional letter signage.

1.2 RELATED REQUIREMENTS

A. Appendix Item 02; Cleveland Public Library Experiential Branding Standards, Moody Nolan.

1.3 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Comply with submittal required in Appendix Item 02, "Exterior Signage Specifications".

1.4 QUALITY ASSURANCE

A. Comply with quality assurance requirements specified in Appendix Item 02, "Exterior Signage Specifications".

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five (5) years of documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Package dimensional letter signs as required to prevent damage before installation.

B. Store under cover and elevated above grade.

PART 2 PRODUCTS

2.1 DIMENSIONAL LETTERS

A. General: Comply with requirements specified in Appendix Item 02.

B. Applications: Building identification.

1. Use individual metal letters.
2. Mounting Location: Exterior as indicated on drawings.

C. Metal Letters:

1. Material: Stainless steel sheet, formed.
2. Thickness: Manufacturer's standard for letter size.
3. Letter Height: As indicated on drawings.
4. Text and Typeface: As indicated in Appendix Item 02.
5. Finish: Non-directional satin, No. 6 As selected by Architect from manufacturer's full range.

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6. Mounting: Projected mount with brackets.

2.2 ACCESSORIES

A. Fasteners: Stainless steel.

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, unless otherwise indicated.

C. Protect from damage until Final Completion; repair or replace damaged items.

END OF SECTION

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SECTION 10 14 23 - PANEL SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. ADA panel signs.

1.2 RELATED REQUIREMENTS

A. Appendix Item 02; Cleveland Public Library Experiential Branding Standards, Moody Nolan.

B. Section 10 11 43 - Visual Display Wall Panels: Slatwall with digital printed signage.

C. Section 10 14 19 - Dimensional Letter Signage: Exterior signage.

1.3 DEFINITIONS

A. Service Rooms: Mechanical, electrical, janitorial, storage, and other rooms used exclusively for service of the building.

1.4 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

C. OBC-2024 - 2024 Ohio Building Code; 2024.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's product literature for each type of panel sign, indicating styles, font, foreground and background colors, locations, and overall dimensions of each sign.

C. Shop Drawings:

1. Include dimensions, locations, elevations, materials, and text and graphic layout.

2. Schedule: Provide information sufficient to completely define each panel sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.

a. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.

b. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.

c. Submit for approval by Owner through Architect prior to fabrication.

D. Samples: Submit one sample of each type of sign, of size similar to that required for project, indicating sign style, font, and method of attachment.

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1.6 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

1.7 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain minimum ambient temperature during and after installation.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Accessibility Requirements: Comply with ADA Standards and ICC A117.1 and OBC-2024, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.

2.2 PANEL SIGNAGE

A. Panel Signage: Comply with requirements indicated in Appendix Item 02.

1. Application: Room and door signs.
2. Description: Flat signs with applied character panel media, tactile characters.
3. Sign Size: Refer to Appendix Item 02.
4. Total Thickness: 1/8 inch.
5. Color and Font: As indicated in Appendix Item 02.
6. Material: PVC plastic base panel with applied plastic letters and braille.
    a. Provide product(s) indicated in Appendix Item 02.
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: Concealed screws and hidden panel fasteners.
11. Two-Sided Glazed Partition Mounting: Silicone; provide blank backplate that matches panel sign when mounting on glass.

2.3 SIGNAGE APPLICATIONS

A. Room and Door Signs:

1. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
    a. Appendix Item 02; Sign Type G and G.b
2. Single-User Toilet Rooms: Identify with pictogram, the term "RESTROOM", and braille.

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a. Appendix Item 02; Sign Type E.

3. Room Occupant Load Signs for Assembly Spaces: Identify with the maximum occupant load of the room, to be determined later; post in a conspicuous place near the main exit access door.

a. Appendix Item 02; Sign Type N.3

4. Non-Illuminated Exit Signs: Provide tactile EXIT signage at doors for these locations:

a. Exit discharge doors (the final door providing egress to the exterior of a building).

B. Emergency Evacuation Map Panel Signs:

1. Appendix Item 02; Sign Type O

2. Allow for one map per large assembly rooms.

3. Map content to be provided by Owner.

2.4 ACCESSORIES

A. Concealed Screws and Hidden Panel Fasteners: Noncorroding metal and plastic.

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, in accordance with ADA Standards and ICC A117.1.

D. Protect from damage until Substantial Completion; repair or replace damaged items.

END OF SECTION

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SECTION 10 26 00 - WALL AND DOOR PROTECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. (WP-1, WP-3) Corner guards.

1.2 RELATED REQUIREMENTS

A. Section 06 10 53 - Miscellaneous Rough Carpentry: Blocking for wall and corner guard anchors.

B. Section 06 83 16 - Fiberglass Reinforced Paneling: Protective wall covering for utilitarian applications.

C. Section 08 71 00 - Door Hardware: Standard door protection plates and trim.

1.3 REFERENCE STANDARDS

A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2024.

B. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents; 2021.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

D. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies; 2023.

E. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate physical dimensions and anchorage details.

C. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.

1. Submit two sections of corner guards, 12 inches long.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.

B. Protect work from UV light damage.

C. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.

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

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Corner Guards:

1. (Basis of Design) Construction Specialties, Inc: www.c-sgroup.com.
2. Inpro: www.inprocorp.com.
3. Wallprotex: www.wallprotex.com.
4. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 PERFORMANCE CRITERIA

A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.

B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.

C. Fungal Resistance: Unless otherwise noted, provide protection products and assemblies which pass ASTM G21 testing.

2.3 PRODUCT TYPES

A. (WP-1) Plastic Corner Guards - Surface Mounted:

1. Material: Polyethylene terephthalate (PET or PETG); PVC-free with full height extruded aluminum retainer.
2. Performance: Resist lateral impact force of 100 lbs at any point without damage or permanent set.
3. Surface Burning Characteristics: Provide assemblies with flame spread index of 200 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
4. Width of Wings: As indicated on drawings.
5. Corner: Radiused, 1/4 inch.
6. Color: As indicated.
7. Length: One piece, as indicated on drawings.
8. Preformed end caps.
9. Basis of Design: As indicated on drawings.

B. (WP-3) Metal Corner Guards - Surface Mounted:

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1. Material: Type 304 stainless steel, No. 4 finish, 16 gage, 0.0625 inch thick.
2. Width of Wings: 2 inches.
3. Corner: Radiused, 3/16 inch.
4. Length: One piece.
5. Basis of Design:
    a. Construction Specialties; Model CO-8

C. Mounting Brackets and Attachment Hardware: Appropriate to component and substrate.

D. See Section 06 10 53 for wood blocking for wall and corner guard anchors.

2.4 FABRICATION

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

B. Pre-drill holes for attachment.

C. Form end trim closure by capping and finishing smooth.

2.5 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Provide wall and door protection systems of each type from a single source and manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

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

B. Verify that substrate surfaces for adhered items are clean and smooth.

3.2 INSTALLATION

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

B. Position corner guard 4 inches above finished floor to ceiling.

3.3 TOLERANCES

A. Maximum Variation From Required Height: 1/4 inch.

B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

3.4 CLEANING

A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

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

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Commercial toilet accessories.

1.2 REFERENCE STANDARDS

A. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2025.

B. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

C. ASTM C1036 - Standard Specification for Flat Glass; 2025.

D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2025.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement to receive anchor attachments.

1.4 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. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Commercial Toilet and Custodial Accessories:

1. (Basis-of-Design) Bobrick: www.bobrick.com.
2. AJW Architectural Products: www.ajw.com.
3. American Specialties, Inc: www.americanspecialties.com.
4. Bradley Corporation: www.bradleycorp.com.
5. Substitutions: Section 01 60 00 - Product Requirements.

B. Electric Hand/Hair Dryers:

1. (Basis-of-Design) Excel Dryer: www.exceldryer.com.

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C. Diaper Changing Stations:

1. (Basis-of-Design) Koala Kare Products: www.koalabear.com.
2. American Specialties, Inc: www.americanspecialties.com.
3. Bradley Corporation: www.bradleycorp.com.
4. Substitutions: 01 60 00 - Product Requirements.

D. Provide products of each category type by single manufacturer.

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 two 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: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.

2.3 COMMERCIAL TOILET ACCESSORIES

A. Toilet Paper Dispenser: Single jumbo-roll, surface-mounted, ABS plastic unit; black.

1. Basis of Design:
    a. Kimberly-Clark Corporation; Scott Essential Coreless Jumbo Roll Tissue Dispenser, Model 09602: www.kcprofessional.com.
    b. Substitutions: Not permitted.

B. Paper Towel Dispenser: Folded paper type, stainless steel, surface-mounted, with viewing slots on sides as refill indicator and tumbler lock.

1. Capacity: 400 C-fold or 525 multifold minimum.
2. Basis of Design:
    a. Bobrick; B-262 or B-2620.

C. Mirrors: Stainless steel framed, 1/4 inch thick tempered safety glass; ASTM C1048.

1. Size: As indicated on drawings.
2. Frame: 0.05 inchchannel shapes, with mitered corners, and tamperproof hanging system; satin finish.
3. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.
4. Basis of Design:
    a. Bobrick; B-292 Series.

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D. Seat Cover Dispenser: Stainless steel, surface-mounted, reloading by concealed opening at base.
    1. Minimum capacity: 250 seat covers.
    2. Basis of Design:
        a. Bobrick; B-221.

E. Grab Bars: Stainless steel, smooth surface.
    1. Standard Duty Grab Bars:
        a. Push and Pull Point Load: Minimum 250 lbf.
        b. Dimensions: 1-1/4 inch outside diameter, minimum 18-gauge, 0.05-inch steel thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
        c. Finish: Satin.
        d. Length and Configuration: As indicated on drawings.
        e. Basis of Design:
            1) Bobrick; B-5806 Series.

F. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, upward-opening cover secured to cabinet with full-length stainless steel piano-type hinge.
    1. Basis of Design:
        a. Bobrick; B-270

G. Coat Hook - Staff Areas: Double-prong, concealed attachment.
    1. Material: Stainless steel; satin finish.
    2. Basis of Design:
        a. Bobrick: B-6827.

H. Coat Hook - Public Toilet Rooms: Single-prong, concealed attachment; with bumper.
    1. Material: Stainless steel; satin finish.
    2. Basis of Design:
        a. Bobrick; B-9541.

I. Mobile Device Holder: Stainless steel, wall mounted, with hinged laptop cradle and bag hook.
    1. Size: 7-1/2 inch width x 9 inch height x 2-3/8 inch depth
    2. Products:
        a. Bobrick; Klutch B633.
        b. Substitutions: Not permitted.

J. Mesh Basket: Chrome alloy mesh, wall mounted, one pocket basket.
    1. Size: 14 inch width x 4 inch height x 4 inch depth.

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2. Available Products:
    a. LTL Home Products, Inc; More Inside, Model # W8-19342.
    b. Rebrilliant; Mesh Wall Mount Storage Basket, SKU W001874856.
    c. Substitutions: Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. Verify that field measurements are as indicated on drawings.

D. See Section _____ for installation of blocking and reinforcing plates in walls.

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.

3.3 PROTECTION

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

END OF SECTION

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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 53 - Miscellaneous Rough Carpentry: Wood blocking.

1.3 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2026.

B. UL (DIR) - Online Certifications Directory; Current Edition.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide extinguisher ratings and classifications.

C. Shop Drawings: Indicate locations of cabinets, cabinet physical dimensions, rough-in measurements for recessed cabinets, locations of individual fire extinguishers, and accessories required for complete installation.

D. Operation and Maintenance Data: Include test, refill, or recharge schedules and recertification requirements.

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. (Basis of Design) Activar Construction Products Group, Inc. - JL Industries; Cosmic Extinguisher - Multipurpose Chemical: www.activarcpg.com.
2. Fire-End & Croker Corporation: www.croker.com.
3. Larsen's Manufacturing Co: www.larsensmfg.com.
4. Potter-Roemer: www.potterroemer.com.
5. Substitutions: See Section 01 60 00 - Product Requirements.

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B. Cabinets and Accessories:

1. (Basis of Design) Activar Construction Products Group, Inc. - JL Industries; Ambassador Series: www.activarcpg.com.
2. Fire-End & Croker Corporation: www.croker.com.
3. Larsen's Manufacturing Co: www.larsensmfg.com.
4. Potter-Roemer: www.potterroemer.com.
5. Substitutions: See Section 01 60 00 - Product Requirements.

C. Source Limitations:

1. Obtain fire extinguishers and related accessories from a single manufacturer.
2. Obtain cabinets and related accessories from a single manufacturer.

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) for purpose specified and as indicated on drawings.

B. Multipurpose Dry-Chemical-Type Fire Extinguishers: Carbon steel tank, with pressure gauge.

1. Basis-of-Design: Activar - JL Industries; Cosmic FE10C
2. Class: A:B:C.
3. Size: 10 pound.
4. Temperature Range: Minus 65 to 120 degrees F.

2.3 FIRE EXTINGUISHER CABINETS

A. Basis-of-Design:

1. Activar - JL Industries; Ambassador C1017W17.

B. Cabinet Construction: Non-fire rated.

1. Formed galvanized steel sheet; 20-gauge, 0.036-inch thick base metal.

C. Cabinet Configuration: Recessed type.

1. Exterior nominal dimensions of 12 inches wide by 30 inches high by 10 inches deep.
2. Trim: Flat square edge, 3/8 inch deep with 1-3/4 inch wide face.
3. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim.

D. Door: 20-gauge, 0.036-inch metal thickness, reinforced for flatness and rigidity with pull handle and keyed breakable plastic cam lock, SAF-T-LOK. Hinge doors for 180-degree opening with continuous piano hinge.

E. Door Glazing: Tempered glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.

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F. Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

G. Fabrication: Weld, fill, and grind components smooth.

H. Finish of Cabinet Exterior Trim and Door: Baked enamel, color as selected by Architect.

I. Finish of Cabinet Tub Interior: White colored enamel.

2.4 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated; designed for securing extinguisher to cabinet, of type(s) and size(s) required for specified extinguisher(s).

B. Lettering: Complying with authorities having jurisdiction; "FIRE EXTINGUISHER" text, black, diecut vinyl self-adhesive 2-inch high letters, for application to cabinet door.

1. Orientation: Ascending.
2. Nominal Size: 4-1/2" x 21"
3. Basis-of-Design: Activar - JL Industries; LDCHBFE-2.

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.

B. Install cabinets plumb and level in wall openings, 48 inches from finished floor to top of cabinet.

C. Secure rigidly in place.

D. Place extinguishers and accessories in cabinets.

E. Identification:

1. Apply vinyl lettering on fire-protection cabinets after painting is complete.

END OF SECTION

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SECTION 10 56 17 - WALL MOUNTED STANDARDS AND SHELVING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Steel shelf standards, brackets, and accessories.

B. Closet rods for mounting on brackets.

C. Plastic Laminate Shelves.

1.2 RELATED REQUIREMENTS

A. Section 06 10 53 - Miscellaneous Rough Carpentry: Wood blocking in walls for attachment of standards.

1.3 REFERENCE STANDARDS

A. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.

1.5 QUALITY ASSURANCE

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

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products under cover and elevated above grade.

B. Store products in manufacturer's unopened packaging until ready for installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Steel Shelf Standards and Brackets:

1. Knape & Vogt Manufacturing Company: www.knapeandvogt.com.

2.2 COMPONENTS

A. Steel Shelf Standards, Brackets, and Accessories:

1. Extra-Duty Shelf Standards and Brackets: Double-slotted channel standards for brackets adjustable in 1 inch increments along entire length of standard, drilled and countersunk for screws.

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a. Product: KV 85/185.

b. Load Capacity: Recommended by manufacturer for loading of 300 to 680 pounds per pair of standards.

c. Material: Steel.

d. Lengths: As indicated on drawings.

e. Finish: Powder-coated, white; provide screws with matching heads.

f. Brackets: Double tab type, locking into slots; size to suit shelves; same finish as standards.

g. Bracket Quantity: Provide one bracket for each 24 inches of standard length.

2. Closet Rods: Steel tubing for wall mounting in flange fittings.

a. Type: Round chrome look, heavy duty; 1-1/16 inch outside diameter, 0.109 inch wall thickness.

b. Length: As required for application, up to 12 feet.

c. Provide mounting fittings to suit application.

B. Shelving:

1. Plastic Laminate Faced Shelves: Particleboard or medium density fiberboard covered with high pressure decorative laminate on both sides.

a. Edge Finish: Matching laminate, all four edges.

b. Substrate Thickness: 3/4 inch, nominal.

c. Length: As indicated on drawings.

d. Laminate: NEMA LD 3 Type HGL.

e. Laminate Color and Pattern: As indicated on drawings.

f. Shelf Quantity: Provide one shelf for each 24 inches of length of standard, per pair of standards, unless otherwise indicated.

C. Fasteners: Screws as recommended by manufacturer for intended application or as otherwise required by project conditions. Finish of exposed to view fasteners to match finish of standards and other components.

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.

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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. Install in accordance with manufacturer's instructions.

B. Mount standards or brackets to solid backing capable of supporting intended loads.

C. Install brackets, shelving, and accessories.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

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SECTION 11 52 11 - GREEN SCREENS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Chroma key compositing screen assemblies.

1.2 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's catalog cuts and descriptive information on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver screens to project site in manufacturer's original unopened packaging, and inspect for damage and proper size before accepting delivery.

B. Store in a protected, clean, dry area with temperature maintained above 50 degrees F, and stack in accordance with manufacturer's recommendations.

PART 2 PRODUCTS

2.1 GREEN SCREENS

A. Available Products:

1. Elgato; Green Screen MT: https://www.elgato.com/us/en/p/green-screen-mt
2. Gradus Group LLC; Angler WM-CG-7579 Chroma Green Retractable Background: www.anglerlights.com.
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Chroma Key Compositing Screens: Factory assembled unless otherwise indicated.

1. Located in MEETING 107: Manual, chroma green fabric screen, wall mounted.
    a. Screen Dimensions: Nominal, 79 inch high by 75 inch wide.

C. Exposed Screen Cases: Steel, with integral roller brackets.

1. Finish: Baked enamel.
2. Color: White.
3. End Caps: Steel; finished to match case.
4. Mounting: Wall.

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D. Manually-Operated Screens:

1. Roller: 1-3/4 inch aluminum; spring loaded with locking device.
2. Screen Pull: Ring on bottom bar.
3. Vertical Tensioning: Screen fabric weighted at bottom with steel bar and plastic end caps.

E. Provide mounting hardware, brackets, supports, fasteners, and other mounting accessories required for a complete installation, in accordance with manufacturer's recommendations for specified substrates and mountings.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions, using manufacturer's recommended hardware for relevant substrates.

B. Do not field cut screens.

C. Install screens in mountings as specified and as indicated on drawings.

D. Install plumb and level.

E. Adjust screens and related hardware in accordance with manufacturer's instructions for proper placement and operation.

3.2 PROTECTION

A. Protect installed products until completion of project.

B. Touch up, repair, or replace damaged products before Date of Substantial Completion.

END OF SECTION

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SECTION 12 24 00 - WINDOW SHADES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. (WT-1) Interior manual roller shades.

1.2 RELATED REQUIREMENTS

A. Section 06 10 53 - Miscellaneous Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

1.3 REFERENCE STANDARDS

A. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2023, with Errata.

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

1.4 ADMINISTRATIVE REQUIREMENTS

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

B. Sequencing:

1. Do not fabricate shades until field dimensions for each opening have been taken with field conditions in place.

2. Do not install shades until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.

C. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.

D. Verification Samples: Minimum size 6 inches square, representing actual materials, color and pattern.

E. Project Record Documents: Record actual locations of control systems and show interconnecting wiring.

F. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.

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1.6 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of this type with minimum five (5) years of documented experience with shading systems of similar size and type.

1. Factory training and demonstrated experience.

1.7 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.

1.8 FIELD CONDITIONS

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

1.9 WARRANTY

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

B. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:

1. Shade Hardware: Ten years.

2. Fabric: 25 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Interior Manually Operated Roller Shades:

1. (Basis of Design) MechoShade Systems LLC; Mecho/5x System: www.mechoshade.com.

2. Hunter Douglas Architectural: www.hunterdouglasarchitectural.com.

3. Legrand North America, LLC: www.legrand.us/commercial-shading.

4. MechoShade Systems LLC: www.mechoshade.com.

B. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

2.2 ROLLER SHADES

A. General:

1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.

2. Provide shade system that operates smoothly when shades are raised or lowered.

B. Roller Shades:

1. Description: Single roller, manually operated fabric window shades.

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a. Drop Position: Regular roll.

b. Mounting: Wall mounted Window jamb mounted.

c. Size: As indicated on drawings.

d. Fabric: As indicated under Shade Fabric article..

2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.

a. Material: Steel, 1/8 inch thick.

b. Single Shade Operation Width: Up to 180 inches, maximum.

3. Roller Tubes:

a. Material: Extruded aluminum.

b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.

c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.

d. Capable of being removed and reinstalled without affecting roller shade limit adjustments.

4. Hembars: Designed to maintain bottom of shade straight and flat.

a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.

5. Clutch Operator: Manufacturer's standard material and design integrated with bracket/brake assembly.

a. Heavy-duty, 1/8 inch steel mounting bracket and integrated steel brake. Clutch and sprocket assembly affix shade support and user control to structure independently of roller tube components.

b. Provide a permanently lubricated brake assembly mounted on an oil-impregnated hub with wrapped spring clutch.

c. Brake must withstand minimum pull force of 50 lb in the stopped position.

d. Mount clutch/brake assembly on the support brackets, fully independent of the roller tube components.

6. Drive Chain: Continuous loop stainless steel beaded ball chain, 100 pounds minimum breaking strength. Provide upper and lower limit stops.

a. Chain Retainer: Chain tensioning device complying with WCMA A100.1, for anchoring pull chain to window frame bottom.

b. Limit Stops: Bead stops affixed to chain and traveling across multiple shades to maintain consistent shade band alignment at top and bottom of shade and prevent damage.

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7. Managed Lift: Required lifting force of 3 lb to a maximum of 5 lb for single-band or multi-band shades up to 5 bands and a maximum of 50 lb shade hanging weight.
8. Accessories:
    a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; baked enamel finish.
        1) Color: MTL-3, specified in Section 05 05 13.
        2) Profile: Square.
        3) Configuration: Captured; fascia stops at bracket end.

2.3 SHADE FABRIC

A. Fabric - Type _____: Nonflammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
    1. Performance Requirements:
        a. Flammability: Pass NFPA 701 large and small tests.
    2. Roll Width: 126 inches.
    3. Basis of Design Product: As indicate on drawings; Finish Selections/A910.

2.4 ROLLER SHADE FABRICATION

A. Field measure finished openings prior to ordering or fabrication.
B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
    1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and finished floor or window stool.
    2. Horizontal Dimensions - Inside Mounting: Provide symmetrical light gaps on both sides of shade not to exceed 3/4 inch total.
    3. Horizontal Dimensions - Outside Mounting: Extend shades 2 inches beyond jambs on each side.
C. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

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C. 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 TOLERANCES

A. Ensure alignment of shade bands within single EDU group does not exceed plus or minus 1/8 inches and alignment between shade groupings does not exceed plus or minus 1/4 inches.

B. Ensure dimensional tolerances of maximum 1/16 inches for horizontal surface levelness of shade pocket.

3.5 ADJUSTING

A. Adjust, align, and balance roller shades to operate smoothly, safely, and free from binding or malfunction throughout operational range.

B. Adjust level, projection, and shade centering from mounting bracket. Ensure no telescoping of shade fabric. Ensure smooth shade operation.

3.6 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

3.7 CLOSEOUT ACTIVITIES

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

3.8 PROTECTION

A. Protect installed products from subsequent construction operations.

B. Touch-up, repair, or replace damaged products before Substantial Completion.

END OF SECTION

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SECTION 12 36 00 - COUNTERTOPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Countertops for architectural cabinet work.

B. Wall panels for architectural column covers.

C. Wall-hung countertops.

1.2 RELATED REQUIREMENTS

A. Section 06 41 00 - Architectural Woodwork.

1.3 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2022.

B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2025a.

C. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

E. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

F. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

G. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

H. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

I. PS 1 - Structural Plywood; 2023.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.

2. Storage and handling requirements and recommendations.

C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.

D. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.

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E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

1.5 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.

1.6 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. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.

1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch nominal thickness.

a. Finish: Matte or suede, gloss rating of 5 to 20.

b. Surface Color and Pattern: As indicated on drawings.

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

3. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Custom Grade.

B. Solid Surfacing Countertops: Solid surfacing sheet over continuous substrate.

1. Flat Sheet Thickness: 1/2 inch, minimum.

2. Solid Surfacing Sheet: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous; no surface coating; color and pattern consistent throughout thickness.

a. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.

b. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.

c. Color and Pattern: As indicated on drawings.

3. Other Components Thickness: 1/2 inch, minimum.

4. Exposed Edge Treatment: Built up to minimum 1-1/2 inch thick; square edge.

5. Back and End Splashes: Same sheet material, square top.

6. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Premium Grade.

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C. Solid Surfacing Wall Panels - for Column Covers: Solid surfacing sheet over continuous substrate.

1. Flat Sheet Thickness: 1/2 inch, minimum.
2. Solid Surfacing Sheet: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous; no surface coating; color and pattern consistent throughout thickness.
    a. Surface Burning Characteristics: Flame spread index of 200, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
    b. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
3. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Premium Grade.
    a. Comply with additional requirements indicated on drawings.

D. Stainless Steel Countertops: ASTM A240/A240M, Type 304, stainless steel sheet; 16 gauge, 0.0625 inch nominal sheet thickness.

1. Finish: 4B satin brushed finish.
2. Exposed Edge Shape: Straight turndown with return; 1-1/2 inch high face, 1/2 inch return to face of case; reinforced with hardwood or steel.
3. Back and End Splashes: Same material; welded 1/4 inch radius coved joint to countertop; square top edge with 1 inch wide top surface and minimum 1/2 inch turndown.
    a. Splash Dimensions: As indicated on drawings.

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. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

2.3 FABRICATION

A. Fabricate all countertops with eased edges and corners.

B. 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.

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C. 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.

D. Solid Surfacing: Fabricate tops and wall panels up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

E. Stainless Steel: Fabricate tops up to 144 inches long in one piece including nosings and back and end splashes; accurately fitted mechanical field joints in lengths over that dimension are permitted.

1. Weld joints; grind smooth and polish to match.

2. Provide stainless steel hat channel stiffeners, welded or soldered to underside, where indicated on drawings.

3. Provide wall clips for support of back/end splash turndowns.

4. Sound Deadening: Apply water resistant, fire resistant sound deadening mastic to entire bottom surface.

F. Wall-Mounted Counters: Provide brackets as indicated on drawings.

1. Brackets are specified in Section 06 41 00.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. 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. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

C. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.

D. Attach stainless steel countertops using stainless steel fasteners and clips.

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E. 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

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SECTION 12 48 13 - ENTRANCE FLOOR MATS AND FRAMES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Modular entrance mat.

B. Recessed mat frames.

1.2 RELATED REQUIREMENTS

A. Section 09 68 13 - Tile Carpeting: Carpet type walk-off mat.

1.3 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating properties of walk-off surface, component dimensions and frame characteristics.

C. Shop Drawings: Indicate dimensions and details for recessed frame.

1. For recessed frames located within a dimensionally restricted area, show dimensions of space within which the frame will be installed.

D. Samples: Submit two samples, illustrating pattern, color, finish, and edging in manufacturer's standard sizes.

E. Maintenance Data: Include cleaning instructions, and stain removal procedures.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Floor Mats:

1. (Basis-of-Design) Construction Specialties, Inc; Entrance Mats: www.c-sgroup.com.
2. Kadee Industries: www.kadeeindustries.com.
3. Milliken & Company: www.milliken.com.
4. Nystrom, Inc: www.nystrom.com.
5. Pawling Corporation: www.pawling.com.
6. Reese Enterprises, Inc; _____: www.reeseusa.com.
7. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 FLOOR MATS

A. Modular Entrance Mat: PET-G tread rails with extruded aluminum hinge connectors, and perimeter trim for recessed installation.

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1. Thickness: 7/16 inch (0.43 inch).
2. Rail Size: 2 inch o.c. by width of entry vestibule.
3. Tread Inserts: Cut nylon pile.
4. Structural Capacity: Capable of supporting rolling load of ____ lb without permanent deformation or noticeable deflection.
5. Colors: As indicated on drawings.

B. Recessed Frame: 1/4 inch thick aluminum exposed top strip, zinc coated steel concealed bottom strip, 3/4 inch deep, with anchoring features and TPE trim fillers.
1. (Basis-of-Design) Construction Specialties; LB – Level Base Frame.

2.3 FABRICATION

A. Construct recessed mat frames square, tight joints at corners, rigid. Coat surfaces with protective coating where in contact with cementitious materials.

B. Fabricate mats in single unit sizes; fabricate multiple mats where indicated on drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that floor opening for mats are ready to receive work.

3.2 PREPARATION

A. Mats: Verify size of floor recess before fabricating mats.

B. Vacuum clean floor recess.

3.3 INSTALLATION

A. Install frames to achieve flush plane with finished floor surface.

B. Install walk-off surface in floor recess flush with finish floor after cleaning of finish flooring.

3.4 TOLERANCES

A. Maximum Gap Formed at Recessed Frame From Mat Size: 1/4 inch.

END OF SECTION

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SECTION 14 47 23 - CHAIN HOISTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electric chain hoists.

1.2 RELATED REQUIREMENTS

A. Section 05 12 00 - Structural Steel Framing.

B. Section 26 05 83 - Wiring Connections.

1.3 REFERENCE STANDARDS

A. 29 CFR 1910 - Occupational Safety and Health Standards; Current Edition.

B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices; 2022.

D. ASME B20.1 - Safety Standard for Conveyors and Related Equipment; 2021.

E. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling; 2024b.

F. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

G. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

H. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2024.

I. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi, 144 ksi, and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2025a.

J. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Errata (2026).

K. ITS (DIR) - Directory of Listed Products; Current Edition.

L. NEMA MG 00001 - Motors and Generators; 2024.

M. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. UL (DIR) - Online Certifications Directory; Current Edition.

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1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate installation of lifts with adjacent construction using necessary attachments; provide anchoring devices in accordance with manufacturer's installation instructions; coordinate installation of structural steel components.

1. Electrical System: Coordinate utility and electrical system connections to ensure they are made in an orderly and expeditious manner.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on material descriptions, construction details, component dimensions and profiles, and finishes; include data on rated capacities, electrical and operating characteristics, and necessary accessories.

C. Shop Drawings: Indicate required opening dimensions and tolerances, perimeter conditions of construction, and diagrams for power, signal, and control wiring.

D. Operation Data: Provide operating instructions, and identify unit limitations.

E. Maintenance Data: Provide unit maintenance information, lubrication cycles, and spare parts manual.

1.6 QUALITY ASSURANCE

A. Welder Qualifications: Welding processes and welding operators qualified within previous 12 months in accordance with AWS D1.1/D1.1M.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Performance Requirements: Electric chain hoists.

1. Designed, fabricated, and installed to comply with applicable requirements of ASME, FEM/ISO, NFPA 70 and OSHA.

2. Lift and lower loads in response to operator's use of pendant controller.

3. Capacity Overload: Hoist must not lift load that exceeds rated capacity.

4. Hoists are shipped with the clutch set for 10 percent higher than the rated capacity.

5. Power Loss Protection: Braking system to lock hoist in place in event of power loss.

B. Structural Performance: Provide factory-fabricated structures capable of withstanding the following loads and stresses without damage or failure.

1. Loading: Comply with applicable requirements of ASCE 7.

2. Platform and Framing Deflection: Limited to 1/360 of span length, without permanent deformation.

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3. Thermal Movement: Provide material lift assemblies to accommodate thermal movement caused by ambient temperature change of 120 degrees F and surface temperature change of 180 degrees F without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects on components.
4. Fabricate frame, edge, and platform supports from structural or formed steel shapes, with platform and hinged edge welded to supports, chamfer edge to minimize obstructing material-handling vehicles; assembly to withstand deformation during operating and stored periods.

C. Provide lift as indicated with necessary capacity, size, operation, function, and construction; with safety devices, controls, and accessories complying with applicable standards of 29 CFR 1910, ASME A17.1, and ASME B20.1.

2.2 ELECTRIC CHAIN HOISTS

A. Manufacturers:
1. (Basis of Design) Harrington Hoists, a Kito Crosby brand: www.harringtonhoists.com.
2. Coffing Hoists, Columbus McKinnon Corporation: CoffingHoist.com.
3. Gorbel Inc: www.gorbel.com.
4. Hoist Equipment Co., Inc: www.hoistequipment.com.
5. OZ Lifting Products LLC: www.ozliftingproducts.com.
6. Spanco, a subsidiary of Promise to Perform Industries, Inc: www.spanco.com.

B. Electrically powered, pendant operated chain hoist to be attached to trolleys on cranes and other material handling equipment to lift and move loads;
1. Model NERG025S as Manufactured by Harrington Hoists.
a. Speed: Single.

C. Operational Functions: Design and fabricate chain hoist to lift specified load and perform functions described in the "Performance Requirements" Paragraph.
1. Lifting Capacity: 2-1/2 tons.
2. Number of Falls: One.
3. Lift Speed for Single Speed Model: 22 feet per minute.
4. Motor Horsepower: 4.7 HP.

D. Construction: Chain hoist is housed in an aluminum, compact housing and include these features:
1. Low voltage, 24 VAC control circuit for operator protection.
2. Modular DC brake and clutch is easily accessible for routine inspection and/or service.
3. Totally enclosed, fan cooled motor.
4. Case hardened gears and other components.
5. Mainline contactor controlled by Emergency-Stop on the pendant control handle.

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E. Hoist Control: Pendant type control device to functionally operate chain hoist as indicated on reviewed shop drawings.

1. Type: Pendant type control handle equipped with:

a. UP, DOWN switch and Emergency Stop to operate hoist.

b. Pendant cable with wire rope strain relief.

2. Limit Switches: Equip chain hoist system with modular upper and lower limit switches.

F. Accessories:

1. Chain Container: Manufacturer's standard canvas bag type.

G. Suspension: Single point connection from four-wheeled trolley suspended from W8.

2.3 COMPONENTS

A. Geared Motor: Comply with NEMA MG 1; designed for continuous duty at ambient temperatures from 32 to 102 degrees F.

B. Electrical Components, Boxes, Conduit, Wiring, and Devices: Comply with NFPA 70, and UL (DIR) or ITS (DIR) listed and labeled, and marked as applicable for proposed locations.

C. Controllers for chain hoists:

1. Push button control on 12-foot straight cord.

D. Grease Fittings: Provide as necessary for lubricating bearings requiring periodic lubrication, automatic feed type grease cups, and visible and easily accessible lubrication points.

E. Maintenance Devices: Provide as necessary within lift system, supported on structural members within accessible locations.

F. Alarm: Provide audible and visual alarm system that indicates lift system is engaged, with manual reset.

2.4 MATERIALS

A. Structural Steel Sections: ASTM A36/A36M.

B. Steel Plates, Shapes, and Bars: ASTM A6/A6M or ASTM A283/A283M.

C. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized in accordance with ASTM A153/A153M where connecting galvanized hardware components.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that existing site dimensions of project construction adjacent to lift location, including platform heights, sub-level area dimensions, and slope of access routes comply with project requirements prior to fabrication.

B. Verify that locations for electrical rough-in connections to system equipment are in acceptable locations before installing equipment.

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C. Verify that electrical power is available and of correct characteristics.

D. Do not proceed with installation until unacceptable conditions have been corrected.

3.2 INSTALLATION

A. Install lift unit securely to supporting structure in accordance with manufacturer's written instructions.

1. Set square and level.

2. Anchor unit securely.

3. Install electrical connections for fully operational system.

B. Control Stations: Install in accordance with manufacturer's written instructions and in compliance with specified requirements.

3.3 ADJUSTING

A. Adjust lift equipment to operate smoothly and safely.

B. Verify vertical travel of lift system, and adjust as necessary to maintain operating range indicated.

3.4 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate operation of system to Owner's personnel.

1. Use operation and maintenance data as reference during demonstration.

2. Briefly describe function, operation, and maintenance of each component.

B. Training: Train Owner's personnel on operation and maintenance of system.

1. Use operation and maintenance manual as training reference.

2. Provide minimum of one day of training.

3. Instructor: Manufacturer's training personnel.

END OF SECTION

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SECTION 21 05 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Above ground piping.

B. Escutcheons.

C. Mechanical couplings.

D. Pipe hangers and supports.

E. Pipe sleeves.

F. Piping specialties.

G. Pressure gauges.

1.2 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 09 91 13 - Exterior Painting: Preparation and painting of exterior fire protection piping systems.

C. Section 09 91 23 - Interior Painting: Preparation and painting of interior fire protection piping systems.

D. Section 21 05 23 - General-Duty Valves for Water-Based Fire-Suppression Piping.

E. Section 21 05 53 - Identification for Fire Suppression Piping and Equipment: Piping identification.

F. Section 21 12 00 - Fire-Suppression Standpipes: Standpipe design.

G. Section 21 13 00 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

1.3 REFERENCE STANDARDS

A. ASME A112.18.1 - Plumbing Supply Fittings; 2024.

B. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2022.

C. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2025, with Errata.

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D. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.

E. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.

F. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2021.

G. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard; 2025.

H. ASME B16.9 - Factory-Made Wrought Buttwelding Fittings; 2024.

I. ASME B16.11 - Forged Fittings, Socket-Welding and Threaded; 2021.

J. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

K. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

L. ASME B16.25 - Buttwelding Ends; 2022.

M. ASME B36.10M - Welded and Seamless Wrought Steel Pipe; 2022.

N. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

O. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.

P. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2021.

Q. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2025.

R. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2025.

S. ASTM A536 - Standard Specification for Ductile Iron Castings; 2024.

T. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2021.

U. ASTM B75/B75M - Standard Specification for Seamless Copper Tube; 2020.

V. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

W. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

X. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2024.

Y. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

Z. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.

AA. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.

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BB. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Errata (2026).

CC. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2021.

DD. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2023.

EE. AWWA C606 - Grooved and Shouldered Joints; 2022.

FF. FM (AG) - FM Approval Guide; Current Edition.

GG. ITS (DIR) - Directory of Listed Products; Current Edition.

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

II. NFPA 1963 - Standard for Fire Hose Connections; 2019.

JJ. UL (DIR) - Online Certifications Directory; Current Edition.

KK. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

LL. UL 405 - Standard for Safety Fire Department Connection Devices; Current Edition, Including All Revisions.

MM. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's catalog information. Indicate valve data and ratings.

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

D. Project Record Documents: Record actual locations of components and tag numbering.

E. Operation and Maintenance Data: Include installation instructions and spare parts lists.

F. BIM coordination drawings which include coordinating with architecture, HVAC, plumbing, structure and architectural systems along with existing conditions.

1.5 QUALITY ASSURANCE

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

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B. Installer Qualifications: Company specializing in performing work of the type specified in this section.

1. Minimum three years experience.

2. Approved by manufacturer.

C. Comply with FM (AG), UL (DIR), and ITS (DIR) or Warnock Hersey requirements.

D. Valves: Bear FM (AG), UL (DIR), and ITS (DIR) or Warnock Hersey product listing label or marking. Provide manufacturer's name and pressure rating marked on valve body.

E. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

F. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

1.7 WARRANTY

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

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

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Sprinkler-based System:

1. Comply with NFPA 13.

2. See Section 21 13 00.

B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

C. Provide system pipes, fittings, sleeves, escutcheons, seals, and other related accessories.

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2.2 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A795 Schedule 10, ASME B36.10M Schedule 5, ASTM A53 Schedule 40, ASTM A135/A135M Schedule 10, ASTM A135/A135M UL listed light wall type, or ASTM A795 Schedule 40, black.

1. Steel Fittings: ASME B16.9 wrought steel, buttwelded, ASME B16.25 buttweld ends, ASTM A234/A234M wrought carbon steel or alloy steel, ASME B16.5 steel flanges and fittings, or ASME B16.11 forged steel socket welded and threaded.
2. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.

B. Copper Tube: ASTM B75/B75M or ASTM B88 (ASTM B88M), drawn temper.

1. Type: Type K.
2. Fittings: ASME B16.18 or ASME B16.22.
3. Joints: Brazed.

2.3 PIPE SLEEVES

A. Vertical Piping:

1. Sleeve Length: 1 inch above finished floor.
2. Provide sealant for watertight joint.
3. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in fire proof caulk around penetration.

B. Pipe Passing Through Mechanical, Laundry, and Animal Room Floors above Basement:

1. Galvanized steel pipe or black iron pipe with asphalt coating.
2. Connect sleeve with floor plate except in mechanical rooms.

C. Clearances:

1. Provide allowance for insulated piping.
2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
3. Rated Openings: Caulked tight with firestopping material complying with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.

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2.4 ESCUTCHEONS

A. Manufacturers:

1. Fire Protection Products, Inc: www.fppi.com/#sle.com/#sle.
2. Tyco Fire Protection Products: www.tyco-fire.com/#sle.
3. Viking Group Inc: www.vikinggroupinc.com/#sle.

B. Material:

1. Grade TP304, seamless tube, ASTM A269/A269M stainless steel.
2. Metals and Finish: Comply with ASME A112.18.1.

C. Construction:

1. One-piece for mounting on chrome-plated tubing or pipe and one-piece type elsewhere.
2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

2.5 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.

1. Manufacturers:
   a. AFCON, a brand of Anvil International: www.anvilintl.com/#sle.
   b. FNW: www.fnw.com/#sle.
   c. Others as approved by engineer..

B. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.

1. Manufacturers:
   a. AFCON, a brand of Anvil International: www.anvilintl.com/#sle.
   b. FNW: www.fnw.com/#sle.
   c. Others as approved by engineer..

C. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.

D. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

E. Vertical Support: Steel riser clamp.

1. Manufacturers:
   a. Anvil International: www.anvilintl.com/#sle.

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F. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

1. Manufacturers:

a. Anvil International: www.anvilintl.com/#sle.

G. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.6 MECHANICAL COUPLINGS

A. Manufacturers:

1. Anvil International: www.anvilintl.com/#sle.
2. Shurjoint Piping Products, Inc: www.shurjoint.com/#sle.
3. Tyco Fire Protection Products: www.tyco-fire.com/#sle.
4. Victaulic Company; FireLock Style 009H: www.victaulic.com/#sle.

B. Rigid Mechanical Couplings for Grooved Joints:

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

2.7 PIPING SPECIALTIES

A. Air Venting Valves:

B. Test Connections:

1. Combination Inspector's Test Connection and Drain Valve:

a. Provide test connections approximately 10 feet above floor for each or portion of each sprinkler system equipped with an alarm device, located at most remote part of each system.

b. Route combination test connection and drain valve to an open-site drain location, excluding janitor sinks, accepting full flow without negative consequences.

c. Supply discharge orifice with same size as corresponding sprinkler orifice.

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d. Limit vertical height of exterior wall penetration to 2 feet above finished grade.

C. Electric Alarm: Electrically operated chrome-plated gong with pressure alarm switch.

D. Water Flow Switch: Vane-type switch for mounting horizontally or vertically, with two contacts; rated 10 A at 125 VAC and 2.5 A at 24 VDC.

E. Fire Department Connections:

1. Type: Free standing made of corrosion-resistant metal complying with UL 405.

a. Inlets: Two-way, 2-1/2 inch swivel fittings, internal threaded. Thread size and inlets according to NFPA 1963 or authority having jurisdiction. Brass caps with gaskets, chains, and lugs.

b. Finish: Chrome.

c. Signage: Raised or engraved lettering 1 inch, minimum, indicating system type.

d. Manufacturers:

1) Elkhart Brass Manufacturing Company, Inc: www.elkhartbrass.com/#sle.

2) Fire End & Croker Corporation: www.croker.com/#sle.

2.8 PRESSURE GAUGES

A. Manufacturers:

1. AGF Manufacturing: www.agfmfg.com/#sle.

2. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.

3. Moeller Instrument Company, Inc: www.moellerinstrument.com/#sle.

4. Omega Engineering, Inc: www.omega.com/#sle.

5. Winters Instruments: www.winters.com/#sle.

B. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.

1. Case: Steel with brass bourdon tube.

2. Diameter: 4-1/2 inch.

3. Mid-Scale Accuracy: One percent.

4. Scale: Display in psi and kPa.

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PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.

B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

C. Install piping to conserve building space, to not interfere with use of space and other work.

D. Group piping whenever practical at common elevations.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. **All piping above gypsum and hard ceilings shall be threaded or welded.**

G. Inserts:

1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

H. Pipe Hangers and Supports:

1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
2. Place hangers within 12 inches of each horizontal elbow.
3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

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4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
6. Provide copper plated hangers and supports for copper piping.
7. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
    a. Painting of interior fire suppression systems is specified in Section 09 91 23.
    b. Painting of exterior fire suppression systems is specified in Section 09 91 13.

I. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

J. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.
1. Painting of interior fire suppression systems is specified in Section 09 91 23.
2. Painting of exterior fire suppression systems is specified in Section 09 91 13.

K. Structural Considerations:
1. Do not penetrate building structural members unless indicated.

L. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
1. Aboveground Piping:
    a. Pack solid using mineral fiber complying with ASTM C592.
    b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
2. All Rated Openings: Caulk tight with firestopping material complying with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.
3. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

M. Escutcheons:
1. Install and firmly attach escutcheons at piping penetrations into finished spaces.
2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.
3. Attach plates at the underside only of suspended ceilings.

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4. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.

N. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.

O. Die-cut threaded joints with full-cut, standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.

P. Piping in areas without ceilings shall be hidden behind soffits to the greatest extent possible.

Q. Sidewall heads shall be used to eliminate piping in open ceiling areas (such as corridors)

R. The architect and engineer shall provide final direction for all piping in open ceiling spaces. The intent is to ensure a clean installation of fire protection piping while minimizing visible piping in areas without ceilings.

S. Drain valves shall be provided where required, as all piping may not be able to slope back to the test drain due to coordination with existing conditions and work from other construction divisions.

3.3 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

C. See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.

END OF SECTION 21 05 00

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SECTION 21 05 23 - GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Two-piece ball valves with indicators.

B. Bronze butterfly valves with indicators.

C. Iron butterfly valves with indicators.

D. Check valves.

E. Bronze OS&Y gate valves.

F. Iron OS&Y gate valves.

G. NRS gate valves.

H. Trim and drain valves.

1.2 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 21 05 53 - Identification for Fire Suppression Piping and Equipment.

C. Section 21 13 00 - Fire-Suppression Sprinkler Systems.

D. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

E. Section 28 46 00 - Fire Detection and Alarm.

1.3 ABBREVIATIONS AND ACRONYMS

A. EPDM: Ethylene-propylene diene monomer.

B. NRS: Non-rising stem.

C. OS&Y: Outside screw and yoke.

D. PTFE: Polytetrafluoroethylene.

1.4 REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).

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B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.

C. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300; 2021.

D. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2025, with Errata.

E. AWWA C606 - Grooved and Shouldered Joints; 2022.

F. FM (AG) - FM Approval Guide; Current Edition.

G. FM 1112 - Examination Standard for Indicating Valves (Butterfly or Ball Type); 2020.

H. FM 1120/1130 - Examination Standard for Fire Service Water Control Valves (OS&Y and NRS Type Gate Valves); 2025.

I. FM 1140 - Examination Standard for Quick Opening Valves 1/4 Inch Through 2 Inch Nominal Size; 2024.

J. FM 1210 - Examination Standard for Swing Check Valves; 2025.

K. UL (DIR) - Online Certifications Directory; Current Edition.

L. UL 258 - Shutoff Valves for Trim and Drain Purposes for Fire Protection Service; Current Edition, Including All Revisions.

M. UL 262 - Gate Valves for Fire-Protection Service; Current Edition, Including All Revisions.

N. UL 312 - Check Valves for Fire-Protection Service; Current Edition, Including All Revisions.

O. UL 1091 - Standard for Butterfly Valves for Fire-Protection Service; Current Edition, Including All Revisions.

1.5 ADMINISTRATIVE REQUIREMENTS

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

1.6 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in CPL's name and registered with manufacturer.

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D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

1.7 QUALITY ASSURANCE

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

B. Installer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.

C. Where listed products are specified, provide products listed, certified, and labeled by FM (AG), UL (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for purpose indicated.

D. Welding Materials and Procedures: Comply with ASME BPVC-IX.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect valve ends and flange faces.
3. Set valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection and protect flanges and specialties from dirt.
    a. Provide temporary inlet and outlet caps.
    b. Maintain caps in place until installation.
2. Store valves in shipping containers and maintain in place until installation.
    a. Store valves indoors and maintain at higher than ambient dew point temperature.
    b. If outdoor storage is unavoidable, store valves off the ground in watertight enclosures.

C. Use the following precautions for handling:

1. Use sling to handle large valves, rig to avoid damage to exposed parts.
2. Do not use operating handles or stems as lifting or rigging points.

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PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Source Limitations: Furnish valves of same kind by same manufacturer.

B. Valve-End Connections:

1. Flanges on Iron Valves: ASME B16.1 or ASME B16.42.
2. Threaded Ends: ASME B1.20.1.
3. Grooved Ends: AWWA C606.

C. Valve Pressure Ratings: Not less than minimum pressure rating indicated or higher as required.

D. Valve Sizes: Same as upstream piping unless otherwise indicated.

E. Valve Actuator Types:

1. Worm-gear actuator with handwheel for quarter-turn valves, except trim and drain valves.
2. Handwheel: For other than quarter-turn trim and drain valves.
3. Hand-lever: For quarter-turn trim and drain valves 2 NPS and smaller.

2.2 TWO PIECE BALL VALVES WITH INDICATORS

A. Manufacturers:

1. FNW: www.fnw.com/#sle.
2. Victaulic Company.

B. UL 1091 and FM 1112 listed.

C. Description:

1. Minimum Pressure Rating: 175 psig.
2. Body Design: Two piece.
3. Body Material: Forged brass or bronze.
4. Port Size: Full or standard.
5. Seat: PTFE.
6. Stem: Bronze or stainless steel.
7. Ball: Chrome-plated brass.

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8. Actuator: Worm gear or traveling nut.
9. Supervisory Switch: Internal or external.
10. End Connections: Threaded or grooved.

2.3 BRONZE BUTTERFLY VALVES WITH INDICATORS

A. Manufacturers:
   1. Ferguson Enterprises Inc: www.fnw.com/#sle.
   2. Fivalco Inc..
   3. Globe Fire Sprinkler Corporation.
   4. Milwaukee Valve Company.
B. UL 1091 and FM 1112 listed.
C. Minimum Pressure Rating: 175 psig.
D. Body Material: Bronze.
E. Seat: EPDM.
F. Stem: Bronze or stainless steel.
G. Disc: Bronze with EPDM coating or stainless steel.
H. Actuator: Worm gear or traveling nut.
I. Supervisory Switch: Internal or external.
J. End Connections: Threaded or grooved.

2.4 IRON BUTTERFLY VALVES WITH INDICATORS

A. Manufacturers:
   1. FNW: www.fnw.com/#sle.
   2. Kennedy Valve: www.kennedyvalve.com/#sle.
   3. Anvil International.
   4. NIBCO INC.
   5. Tyco Fire Products LP.
   6. Victaulic Company.
   7. Zurn Industries, LLC.

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B. UL 1091 and FM 1112 listed.

C. Minimum Pressure Rating: 175 psig.

D. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.

E. Seat: EPDM.

F. Stem: Stainless steel.

G. Disc: Ductile iron with EPDM coating.

H. Actuator: Worm gear or traveling nut.

I. Supervisory Switch: Internal or external.

J. Body Design: Grooved-end or wafer style.

2.5 SWING CHECK VALVES

A. Manufacturers:

1. FNW: www.fnw.com/#sle.
2. Kennedy Valve; AWWA Compliant: www.kennedyvalve.com/#sle.
3. Anvil International.
4. NIBCO INC.
5. Tyco Fire Products LP.
6. Victaulic Company.

B. UL 312 and FM 1210 listed.

C. Minimum Pressure Rating: 175 psig.

D. Body Material: Cast or ductile iron.

E. Clapper: Bronze, EPDM-coated ductile iron, or stainless steel.

F. Seat: Bronze or EPDM-coated bronze.

G. End Connections: Flanged.

2.6 BRONZE OS&Y GATE VALVES

A. Manufacturers:

1. FNW: www.fnw.com/#sle.
2. Milwaukee Valve Company.

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3. NIBCO INC.
4. Zurn Industries, LLC.

B. UL 262 and FM 1120/1130 listed.

C. Minimum Pressure Rating: 175 psig.

D. Body and Bonnet Material: Bronze or brass.

E. Wedge: One-piece bronze or brass.

F. Wedge Seat: Bronze.

G. Stem: Bronze or brass.

H. Packing: Non-asbestos PTFE.

I. Supervisory Switch: External.

J. End Connections: Threaded.

2.7 IRON OS&Y GATE VALVES

A. Manufacturers:

1. FNW; 751 Series: www.fnw.com/#sle.
2. Kennedy Valve; Ken-Seal Series, AWWA Compliant: www.kennedyvalve.com/#sle.
3. NIBCO INC.
4. WATTS.
5. Zurn Industries, LLC

B. UL 262 and FM 1120/1130 listed.

C. Minimum Pressure Rating: 175 psig.

D. Body and Bonnet Material: Cast or ductile iron.

E. Wedge: Cast or ductile iron, or bronze with elastomeric coating.

F. Stem: Brass, bronze, or stainless steel.

G. Packing: Non-asbestos PTFE.

H. Supervisory Switch: External.

2.8 IRON NRS GATE VALVES

A. Manufacturers:

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1. FNW: www.fnw.com/#sle.
2. Victaulic Company.
3. Zurn Industries, LLC.

B. UL 262 and FM 1120/1130 listed.

C. Minimum Pressure Rating: 175 psig.

D. Body and Bonnet Material: Cast or ductile iron.

E. Wedge: Cast or ductile iron with elastomeric coating.

F. Stem: Brass or bronze.

G. Packing: Non-asbestos PTFE.

H. Operation:

1. Operating nut for post-indicating valves.
2. Handwheel for non-post-indicating valves.

I. Post Plate: Provide for post-indicating valves.

J. Supervisory Switch: External.

K. End Connections: Grooved.

2.9 TRIM AND DRAIN VALVES

A. Ball Valves:

1. Manufacturers:
   a. Apollo Flow Controls; Conbraco Industries, Inc.
   b. Milwaukee Valve Company.
   c. Tyco Fire Products LP.
2. Description:
   a. UL 258 or FM 1140 listed.
   b. Pressure Rating: 175 psig.
   c. Body Design: Two piece.
   d. Body Material: Forged brass or bronze.
   e. Port Size: Full or standard.
   f. Seat: PTFE.
   g. Stem: Bronze or stainless steel.

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h. Ball: Chrome-plated brass.

i. Actuator: Hand-lever.

j. End Connections: Threaded or grooved.

B. Angle Valves:

1. Manufacturers:

a. Fire Protection Products, Inc.

b. NIBCO INC.

c. United Brass Works, Inc.

2. Description:

a. UL 258 or FM 1140 listed.

b. Pressure Rating: 175 psig.

c. Body Material: Brass or bronze.

d. Ends: Threaded.

e. Stem: Bronze.

f. Disc: Bronze.

g. Packing: Asbestos free.

h. Handwheel: Malleable iron, bronze, or aluminum.

C. Globe Valves:

1. Manufacturers:

a. NIBCO INC.

b. United Brass Works, Inc.

2. Description:

a. UL 258 or FM 1140 listed.

b. Pressure Rating: 175 psig.

c. Body Material: Bronze with integral seat and screw-in bonnet.

d. Ends: Threaded.

e. Stem: Bronze.

f. Disc Holder and Nut: Bronze.

g. Disc Seat: Nitrile.

h. Packing: Asbestos free.

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i. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 EXECUTION

3.1 EXAMINATION

A. Confirm valve interior to be free of foreign matter and corrosion.

B. Remove packing materials.

C. Examine guides and seats by operating valves from the fully open position to the fully closed position.

D. Examine valve threads and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage.

1. Check bolting for proper size, length, and material.
2. Verify gasket for size, defects, damage, and suitable material composition for service.
3. Replace defective valves with new valves.

3.2 INSTALLATION

A. Install valves in accessible locations to allow for operation, inspections, tests, and maintenance.

B. Install listed valves in accordance with their listing.

C. Install valves in accordance with manufacturer's instructions.

D. Support valves independently of adjacent piping.

E. Install valves in horizontal piping with stem at or above pipe center.

F. Position valves to allow full actuator movement.

G. Install OS&Y valves with full clearance for rising stem. Install surrounding components so they do not interfere with nor are they impacted by full extension of rising stem.

H. Install supervised shutoff valves in supervised-open position.

1. Install permanent identification signs indicating portion of system controlled by each shutoff valve.
2. Install threaded-end valves with unions upstream and downstream.

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I. Install valve tags. See Section 21 05 53. Label valves in accordance with NFPA standard applying to the piping system in which valves are installed.

END OF SECTION 21 05 23

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SECTION 21 05 53 - IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

D. Ceiling tacks.

1.2 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting: Stencil paint.

1.3 REFERENCE STANDARDS

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

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2025.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation instructions.

F. Project Record Documents: Record actual locations of tagged valves.

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PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Automatic Controls: Tags.

B. Control Panels: Nameplates.

C. Instrumentation: Tags.

D. Major Control Components: Nameplates.

E. Piping: Tags.

F. Relays: Tags.

G. Small-sized Equipment: Tags.

H. Valves: Nameplates and ceiling tacks where above lay-in ceilings.

2.2 NAMEPLATES

A. Manufacturers:

1. Carlton Industries, LP.
2. Champion America,
3. Craftmark Pipe Markers
4. emedco.
5. Brimar Industries, Inc: www.pipemarker.com/#sle.
6. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
7. LEM Products Inc.
8. Marking Services, Inc.
9. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.

B. Description: Laminated three-layer plastic with engraved letters.

1. Letter Color: White.
2. Letter Height: 1/4 inch.
3. Background Color: Black.
4. Thickness: 1/8 inch.
5. Plastic: Comply with ASTM D709.

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2.3 TAGS

A. Manufacturers:

1. Advanced Graphic Engraving, LLC: www.advancedgraphicengraving.com/#sle.
2. Brady Corporation: www.bradycorp.com/#sle.
3. Brimar Industries, Inc: www.pipemarker.com/#sle.
4. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
5. emedco.
6. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
7. LEM Products Inc.
8. Marking Services Inc.
9. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

C. Metal Tags: Stainless Steel with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

D. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.4 PIPE MARKERS

A. Manufacturers:

1. Brady Corporation: www.bradycorp.com/#sle.
2. Brimar Industries, Inc: www.pipemarker.com/#sle.
3. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
5. Seton Identification Products, a Tricor Company: www.seton.com/#sle.

B. Color: Comply with ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Color code as follows:

1. Fire Quenching Fluids: Red with white letters.

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2.5 CEILING TACKS

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

PART 3 EXECUTION

3.1 PREPARATION

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

B. Prepare surfaces in accordance with Section 09 91 23 for stencil painting.

3.2 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Apply stencil painting in accordance with Section 09 91 23.

D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

G. Use tags on piping 3/4 inch diameter and smaller.

1. Identify service, flow direction, and pressure.
2. Install in clear view and align with axis of piping.
3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

H. Locate ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 21 05 53

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SECTION 21 13 00 - FIRE-SUPPRESSION SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wet-pipe sprinkler system.

B. System design, installation, and certification.

1.2 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 21 05 00 - Common Work Results for Fire Suppression: Pipe and fittings.

C. Section 21 05 23 - General-Duty Valves for Water-Based Fire-Suppression Piping.

D. Section 21 05 53 - Identification for Fire Suppression Piping and Equipment.

E. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

F. Section 28 46 00 - Fire Detection and Alarm.

1.3 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide; Current Edition.

B. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry; 2018, with Editorial Revision (2020).

C. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2017, with Editorial Revision (2020).

D. ITS (DIR) - Directory of Listed Products; Current Edition.

E. NFPA 1963 - Standard for Fire Hose Connections; 2019.

F. UL (DIR) - Online Certifications Directory; Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

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

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1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Shop Drawings:

1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.

2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components, and accessories. Indicate system controls.

3. Submit shop drawings to Authorities Having Jurisdiction for approval. Submit proof of approval to Engineer.

D. Designer's qualification statement.

E. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

F. Maintenance Materials: Furnish the following for CPL's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements for additional provisions.

2. Extra Sprinklers: Type and size matching those installed in quantity required by referenced NFPA design and installation standard.

3. Sprinkler Wrenches: For each sprinkler type.

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

1.6 QUALITY ASSURANCE

A. Maintain one copy of referenced design and installation standard on site.

B. Comply with FM (AG) requirements.

C. Designer Qualifications: Design system under direct supervision of a Professional Fire Protection Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

D. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

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E. Installer Qualifications: Company specializing in performing the work of this section with minimum 4 years experience and approved by manufacturer.

F. Equipment and Components: Provide products that bear FM (AG) label or marking.

G. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Sprinklers, Valves, and Equipment:

1. Anvil International; _____: www.anvilintl.com/#sle.
2. Globe Fire Sprinkler Corporation
3. Reliable Automatic Sprinkler Co., Inc. (The).
4. Tyco Fire Protection Products; _____: www.tyco-fire.com/#sle.
5. Venus Fire Protection Ltd.
6. Victaulic Company
7. Viking Corporation; _____: www.vikinggroupinc.com/#sle.

2.2 SPRINKLER SYSTEM

A. Sprinkler System: Provide coverage for building areas noted.

B. Occupancy: Light Hazard and Ordinary Hazard Group I.

C. Water Supply: Determine volume and pressure from water flow test.

1. Contractor shall conduct a flow test to determine pressure and flow for their calculations.
2. Revise design when test data available prior to submittals.

D. Interface system with building fire and smoke alarm system.

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E. Provide fire department connections as required by NFPA 13 and NFPA 14..

F. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

G. Pipe Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:

1. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
2. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
3. Manufacturers:
   a. AFCON, a brand of Anvil International; _____: www.anvilintl.com/#sle.
   b. Powers Fasteners, Inc; _____ www.powers.com/#sle.

2.3 SPRINKLERS

A. Suspended Ceiling Type: Recessed pendant type with matching push on escutcheon plate.

1. Response Type: Quick.
2. Coverage Type: Extended.
3. Finish: As specified by architect. .
4. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
5. Manufacturers:
   a. Tyco Fire Protection Products; _____: www.tyco-fire.com/#sle.

B. ***Exposed Area Type: Pendants or Uprights as required by architect. type.***

1. Response Type: Quick.
2. Coverage Type: Extended.
3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

2.4 PIPING SPECIALTIES

A. Test Connections:

1. Inspector's Test Connection for Preaction Systems:
   a. Provide test connections approximately 10 ft above floor for each or portion of each sprinkler system equipped with an alarm device, located at the most remote part of each system.
   b. Route test connection to an open-site drain location, excluding janitor sinks, accepting full flow without negative consequences.

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c. Supply discharge orifice with same size as corresponding sprinkler orifice.

d. Limit vertical height of exterior wall penetration to 2 ft above finished grade.

2. Backflow Preventer Test Connection:

a. Provide downstream of the backflow prevention assembly, listed hose valves with 2.5 inch National Standard male hose threads with cap and chain.

b. Furnish one valve for each 250 gpm of system demand or fraction thereof.

c. Provide permanent sign reading "Test Valve" in accordance with Section 21 05 53.

B. Electric Alarm: Electrically operated chrome plated gong with pressure alarm switch.

C. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.

D. Supervisory Switches:

1. Manufacturers:

a. Potter Electric Signal Company, LLC; CoilKeeper Solenoid Supervisory Switch: www.pottersignal.com/#sle.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with referenced NFPA design and installation standard.

B. Install equipment in accordance with manufacturer's instructions.

C. Locate outside alarm gong on building wall as indicated.

D. Place pipe runs to minimize obstruction to other work.

E. Place pipe runs to minimize obstruction to other work.

F. Place piping in concealed spaces above finished ceilings.

G. If a grid ceiling is installed in the project, center sprinklers in two directions in ceiling tile and provide piping offsets as required.

H. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.

I. Flush entire piping system of foreign matter.

J. Install guards on sprinklers where indicated.

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K. Hydrostatically test entire system.

L. Require test be witnessed by Authority Having Jurisdiction.

3.2 INTERFACE WITH OTHER PRODUCTS

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

3.3 SCHEDULES

A. System Hazard Areas:

1. Mechanical Room: Ordinary Hazard Group 1
2. See drawings for additional hazard levels.

END OF SECTION 21 13 00

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SECTION 22 05 17 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe sleeves.

B. Pipe sleeve-seals.

1.2 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 09 91 13 - Exterior Painting: Preparation and painting of exterior piping systems.

C. Section 09 91 23 - Interior Painting: Preparation and painting of interior piping systems.

D. Section 22 05 23 - General-Duty Valves for Plumbing Piping.

E. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Piping identification.

F. Section 22 07 19 - Plumbing Piping Insulation.

1.3 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2024.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.

C. FM (AG) - FM Approval Guide; Current Edition.

D. UL (DIR) - Online Certifications Directory; Current Edition.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

1.5 QUALITY ASSURANCE

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

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B. Installer Qualifications: Company specializing in performing work of the type specified this section.
   1. Minimum three years experience.
   2. Approved by manufacturer.

C. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

1.7 WARRANTY

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

PART 2 PRODUCTS

2.1 PIPE SLEEVES

A. Manufacturers:
   1. American Polywater Corporation; PZVR Watertight Wall Sleeves for Pipes: www.polywater-haufftechnik.com/#sle.
   2. Flexicraft Industries; Pipe Wall Sleeve: www.flexicraft.com/#sle.

B. Vertical Piping:
   1. Sleeve Length: 1 inch above finished floor.
   2. Provide sealant for watertight joint.
   3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
   4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

C. Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

D. Pipe Passing Through Below Grade Exterior Walls:

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1. Zinc coated or cast iron pipe.
2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

E. Pipe Passing Through Mechanical, Laundry, and Animal Room Floors above Basement:

1. Galvanized steel pipe or black iron pipe with asphalt coating.
2. Connect sleeve with floor plate except in mechanical rooms.

F. Clearances:

1. Provide allowance for insulated piping.
2. Wall, Floor, Partitions, and Beam Flanges: 1 inch greater than external pipe diameter.
3. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.

2.2 PIPE-SLEEVE SEALS

A. Manufacturers:

1. Advance Products & Systems, LLC; Innerlynx: www.apsonline.com/#sle.
2. American Polywater Corporation; PGKD Modular Seals: www.polywater-haufftechnik.com/#sle.
3. Flexicraft Industries; PipeSeal: www.flexicraft.com/#sle.
4. The Metraflex Company; MetraSeal: www.metraflex.com/#sle.

B. Modular Mechanical Sleeve-Seal:

1. Elastomer-based interlocking links continuously fill annular space between pipe and wall-sleeve, wall or casing opening.
2. Watertight seal between pipe and wall-sleeve, wall or casing opening.
3. Size and select seal component materials in accordance with service requirements.
4. Service Requirements:
    a. Underground, buried, and wet conditions.
    b. Fire Resistant: 1 hour, UL (DIR) approved.
5. Glass-reinforced plastic pressure end plates.

C. Sealing Compounds:

1. Provide packing and sealing compound to fill pipe to sleeve thickness.

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2. Combined packing and sealing compounding to match partition fire-resistance hourly rating.

D. Pipe Sleeve Material:

1. Bearing Walls: Steel, cast iron, or terra-cotta pipe.
2. Masonry Structures: Sheet metal or fiber.

E. Wall Sleeve: Steel material with waterstop collar, and nailer end-caps.

F. Sleeve-Forming Disk: Non-conductive plastic-based material, 3 inch thick.

G. Pipeline-Casing Seals:

1. Coated boltless casing-spacer for 4 inch carrier pipe.
2. End Seals: 1/8 inch, pull-on type, rubber or synthetic rubber based.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

3.2 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Structural Considerations: Do not penetrate building structural members unless indicated.

E. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.

1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
2. Aboveground Piping:
    a. Pack solid using mineral fiber complying with ASTM C592.
    b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.

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3. All Rated Openings: Caulk tight with fire stopping material complying with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.

F. Manufactured Sleeve-Seal Systems:

1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a water-tight seal.
6. Install in accordance with manufacturer's recommendations.

G. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.3 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION 22 05 17

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SECTION 22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Ball valves.

B. Check valves.

C. Globe valves.

D. Lubricated plug valves.

1.2 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 08 31 00 - Access Doors and Panels.

C. Section 22 05 53 - Identification for Plumbing Piping and Equipment.

D. Section 22 07 19 - Plumbing Piping Insulation.

E. Section 22 10 05 - Plumbing Piping.

1.3 ABBREVIATIONS AND ACRONYMS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Non-rising stem.

E. OS&Y: Outside screw and yoke.

F. PTFE: Polytetrafluoroethylene.

G. RS: Rising stem.

H. TFE: Tetrafluoroethylene.

I. WOG: Water, oil, and gas.

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1.4 REFERENCE STANDARDS

A. API STD 594 - Check Valves: Flanged, Lug, Wafer, and Butt-Welding; 2022.

B. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).

C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.

D. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard; 2025.

E. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves; 2022, with Errata (2023).

F. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

G. ASME B16.34 - Valves — Flanged, Threaded, and Welding End; 2025.

H. ASME B31.9 - Building Services Piping; 2025.

I. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2025, with Errata.

J. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2022.

K. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2023).

L. ASTM A216/A216M - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service; 2021.

M. ASTM A351/A351M - Standard Specification for Castings, Austenitic, for Pressure-Containing Parts; 2024, with Editorial Revision (2025).

N. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).

O. ASTM A536 - Standard Specification for Ductile Iron Castings; 2024.

P. AWWA C606 - Grooved and Shouldered Joints; 2022.

Q. MSS SP-45 - Drain and Bypass Connections; 2020.

R. MSS SP-67 - Butterfly Valves; 2022.

S. MSS SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends; 2011.

T. MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends; 2018.

U. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service; 2010a.

V. MSS SP-78 - Gray Iron Plug Valves, Flanged and Threaded Ends; 2011.

W. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves; 2019.

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X. MSS SP-85 - Gray Iron Globe and Angle Valves, Flanged and Threaded Ends; 2011.

Y. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

Z. MSS SP-125 - Check Valves: Gray Iron and Ductile Iron, In-Line, Spring-Loaded, Center-Guided; 2018.

AA. NSF 61 - Drinking Water System Components - Health Effects; 2024.

BB. NSF 372 - Drinking Water System Components - Lead Content; 2024.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in CPL's name and registered with manufacturer.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

E. Maintenance Materials: Furnish CPL with one wrench for every five plug valves, in each size of square plug valve head.

1. See Section 01 60 00 - Product Requirements for additional provisions.

1.6 QUALITY ASSURANCE

A. Manufacturer:

1. Obtain valves for each valve type from single manufacturer.

2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.

2. Protect valve parts exposed to piped medium against rust and corrosion.

3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.

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4. Adjust globe, gate, and angle valves to the closed position to avoid clattering.
5. Secure check valves in either the closed position or open position.
6. Adjust butterfly valves to closed or partially closed position.

B. Use the following precautions during storage:
1. Maintain valve end protection and protect flanges and specialties from dirt.
a. Provide temporary inlet and outlet caps.
b. Maintain caps in place until installation.
2. Store valves in shipping containers and maintain in place until installation.
a. Store valves indoors in dry environment.
b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

1.8 EXERCISE THE FOLLOWING PRECAUTIONS FOR HANDLING:

A. Handle large valves with sling, modified to avoid damage to exposed parts.
B. Avoid the use of operating handles or stems as rigging or lifting points.

PART 2 PRODUCTS

2.1 APPLICATIONS

A. Listed pipe sizes shown using nominal pipe sizes (NPS) and nominal diameter (DN).
B. Provide the following valves for the applications if not indicated on drawings:
1. Shutoff: Ball.
2. Throttling: Provide globe.
3. Swing Check (Pump Outlet):
a. 2 inch and Smaller: Bronze swing check valves with bronze disc.
C. Substitutions of valves with higher CWP classes or WSP ratings for same valve types are permitted when specified CWP ratings or WSP classes are not available.
D. Required Valve End Connections for Non-Wafer Types:
1. Copper Tube:

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a. 2 inch and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

E. Domestic, Hot and Cold Water Valves:

1. 2 inch and Smaller:

a. Bronze and Brass: Provide with solder-joint or threaded ends.

F. Sanitary Waste Water Valves:

1. 2-1/2 inch and Larger:

a. Iron Swing Check: Class 125, metal seats.

2.2 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Insulated Piping Valves: With 2 inch stem extensions and the following features:

1. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

D. Valve-End Connections:

1. Threaded End Valves: ASME B1.20.1.

2. Solder Joint Connections: ASME B16.18.

E. General ASME Compliance:

1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.

2. Solder-joint Connections: ASME B16.18.

3. Building Services Piping Valves: ASME B31.9.

F. Potable Water Use:

1. Certified: Approved for use in compliance with NSF 61 and NSF 372.

2. Lead-Free Certified: Wetted surface material includes less than 0.25 percent lead content.

G. Valve Bypass and Drain Connections: MSS SP-45.

H. Source Limitations: Obtain each valve type from a single manufacturer.

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2.3 BRASS, BALL VALVES

A. Two Piece, Full Port with Brass Trim and Female Thread, Male thread, or Solder Connections:
   1. Comply with MSS SP-110.
   2. WSP Rating: 150 psi.
   3. WOG Rating: 600 psi.
   4. Body: Forged brass.
   5. Seats: PTFE.
   6. Stem: Stainless Steel.
   7. Ball: Stainless steel, vented.
   8. Manufacturers:
      a. Apollo Valves: www.apollovalves.com/#sle.
      b. Effebi; Gladiator: www.effebi.com/#sle.
      c. FNW; 410A: www.fnw.com/#sle.

2.4 BRONZE, BALL VALVES

A. General:
   1. Fabricate from dezincification resistant material.
   2. Copper alloys containing more than 15 percent zinc are not permitted.

B. Two Piece, Full Port with Bronze Trim:
   1. Comply with MSS SP-110.
   2. WSP Rating: 150 psi.
   3. WOG Rating: 600 psi.
   4. Body: Forged bronze or dezincified-brass alloy.
   5. Ends Connections: Pipe thread or solder.
   6. Seats: PTFE.
   7. Stem: Stainless steel, blowout proof.
   8. Ball: Stainless steel, vented.
   9. Manufacturers:
      a. Apollo Valves: www.apollovalves.com/#sle.

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b. FNW; X450: www.fnw.com/#sle.

c. NIBCO INC: www.nibco.com/#sle.

2.5 BRONZE, SWING CHECK VALVES

A. General:

1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

B. Class 125:

1. Pressure and Temperature Rating: MSS SP-80, Type 3.
2. Design: Y-pattern, horizontal or vertical flow.
3. WOG Rating: 200 psi.
4. Body: Bronze.
5. End Connections: Threaded or soldered.
6. Disc: Bronze.
7. Manufacturers:
   a. Apollo Valves: www.apollovalves.com/#sle.
   b. NIBCO INC: www.nibco.com/#sle.

2.6 BRONZE, GLOBE VALVES

A. General:

1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

B. Class 125 and Class 250:

1. Class 125:
   a. WOG Rating: 200 psi.
   b. WSP Rating: 125 psi, saturated.
2. Class 250: WOG Rating; 300 psi.
3. Comply with MSS SP-80, Type 1.
4. Body: Bronze with integral seat and screw-in bonnet.

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5. End Connections: Threaded or solder.
6. Bonnet: NRS; Non-rising Stem.
7. Non-Rising Stem: Bronze.
8. Disc: PTFE.
9. Packing: Asbestos free.
10. Handwheel Operator: Malleable iron.
11. Manufacturers:
    a. Apollo Valves: www.apollovalves.com/#sle.
    b. FNW; 1231, Federal: www.fnw.com/#sle.

2.7 LUBRICATED PLUG VALVES

A. Regular Gland with Flanged Ends:
1. Comply with MSS SP-78, Type II.
2. Class 125: CWP Rating: 200 psi.
3. Body: ASTM A48/A48M or ASTM A126, cast iron with lubrication sealing system.
4. Pattern: Regular or short.
5. Plug: Cast iron or bronze with sealant groove.
6. Manufacturers:
    a. Flomatic Valves: www.flomatic.com/#sle.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.
B. Verify valve parts to be fully operational in all positions from closed to fully open.
C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.
D. Should valve is determined to be defective, replace with new valve.

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3.2 INSTALLATION

A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.

B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

C. Where valve support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

D. Install shutoff valves on hot water, cold water, and hot water return lines for each bathroom group and for each hose bib. Install in an accessible location and install an access panel if valve is behind a hard ceiling or wall. Coordinate exact location with engineer and architect prior to installation.

E. Install check valves where necessary to maintain direction of flow as follows:

1. Lift Check: Install with stem plumb and vertical.
2. Swing Check: Install horizontal maintaining hinge pin level.
3. Orient plate-type into horizontal or vertical position, between flanges.

F. Provide chainwheels on operators for valves 4 inch and larger where located 96 inches or more above finished floor, terminating 60 inches above finished floor.

END OF SECTION 22 05 23

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SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Beam clamps.

B. Pipe hangers.

C. Pipe supports, guides, shields, and saddles.

D. Anchors and fasteners.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 05 50 00 - Metal Fabrications.

1.3 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2025.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2024.

G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).

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

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I. 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; 2025.

J. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

L. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

M. FM (AG) - FM Approval Guide; Current Edition.

N. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2025.

O. UL (DIR) - Online Certifications Directory; Current Edition.

P. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

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1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.

1.6 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Installer Qualifications for Field-Welding: As specified in Section 05 50 00.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Provide required hardware to hang or support piping, equipment, or fixtures with related accessories as necessary to complete installation of plumbing work.

B. Provide hardware products listed, classified, and labeled as suitable for intended purpose.

C. Do not use chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.

D. Fire Resistance: Provide hardware rated for 60 minutes resistance unless specifically indicated by the authority having jurisdiction.

E. Materials for Metal Fabricated Supports: Comply with Section 05 50 00.

1. Zinc-Plated Steel: Electroplated in accordance with ASTM B633 unless stated otherwise.

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2. Galvanized Steel: Hot-dip galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M unless stated otherwise.

F. Corrosion Resistance: Use corrosion-resistant metal-based materials fully compatible with exposed piping materials and suitable for the environment where installed.

1. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.

2. Outdoor, Damp, or Wet-Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.

2.2 BEAM CLAMPS

A. Manufacturers:

1. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.

2. FNW; 7201: www.fnw.com/#sle.

3. Unistrut, a brand of Atkore International, Inc: www.unistrut.com/#sle.

B. MSS SP-58 types 19 through 23, 25 or 27 through 30 based on required load.

C. C-Clamp: MSS SP-58 type 23, malleable iron and steel with plain, stainless steel, and zinc finish.

D. Small or Junior Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish. For inverted usage provide manufacturer listed size(s).

E. Wide Mouth Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish.

F. Centerload Beam Clamp with Extension Piece: MSS SP-58 type 30, malleable iron with plain finish.

G. FM (AG) and UL (DIR) Approved Beam Clamp: MSS SP-58 type 19, plain finish.

H. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.

I. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.

2.3 PIPE HANGERS

A. Band Hangers, Adjustable:

1. Manufacturers:

a. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.

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b. Gripple, Inc; Universal Clamp (Threaded): www.gripple.com/#sle.

c. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.

2. MSS SP-58 type 7 or 9, zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.

2.4 PIPE CLAMPS

A. Riser Clamps:

1. Manufacturers:

a. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.

b. FNW; 7020: www.fnw.com/#sle.

c. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.

2. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.

3. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, plain, stainless steel, or zinc plated finish.

4. Copper Tube Pipe Clamp: MSS SP-58 type 8, epoxy plated copper.

5. UL (DIR) listed: Pipe sizes 1/2 to 8 inch.

2.5 PIPE SUPPORTS, GUIDES, SHIELDS, AND SADDLES

A. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.

B. Stanchions:

1. Manufacturers:

a. Anvil International: www.anvilintl.com/#sle.

b. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.

c. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.

2. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.

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3. Provide coated or plated saddles to isolate steel hangers from dissimilar metal tube or pipe.
4. For pipe runs, use stanchions of same type and material where vertical adjustment is required for stationary pipe.

C. U-Bolts:

1. Manufacturers:
   a. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
   b. FNW; 7610: www.fnw.com/#sle.
   c. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.
2. MSS SP-58 type 24, carbon steel u-bolt for pipe support or anchoring.

D. Pipe Shields for Insulated Piping:

1. Manufacturers:
   a. Anvil International: www.anvilintl.com/#sle.
   b. FNW; 7753: www.fnw.com/#sle.
   c. Gregory Industries, Inc: www.gregorycorp.com/#sle.
   d. Substitutions: See Section 01 60 00 - Product Requirements.
   e. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.
2. MSS SP-58 type 40, ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
3. General Construction and Requirements:
   a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
   b. Shields Material: UV-resistant polypropylene with glass fill.
   c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
   d. Service Temperature: Minus 40 to 178 degrees F.
   e. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

E. Pipe Supports:

1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
2. Liquid Temperatures Up to 122 degrees F:
   a. Overhead Support: MSS SP-58 types 1, 3 through 12 clamps.

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b. Support From Below: MSS SP-58 types 35 through 38.

F. Pipe Supports, Thermal Insulated:

1. Manufacturers:

a. Buckaroos, Inc: www.buckaroos.com/#sle.

b. Snappitz: www.snappitz.com/#sle.

2. General Requirements:

a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.

c. Provide pipe supports for 1/2 to 30 inch iron pipes.

d. Insulation inserts to consist of rigid phenolic foam insulation surrounded by 360 degree, PVC jacketing.

3. PVC Jacket:

a. Pipe insulation protection shields to be provided with ball bearing hinge and locking seam.

b. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.

c. Minimum Thickness: 60 mil, 0.06 inch.

G. Copper Pipe Supports:

1. Manufacturers:

a. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.

b. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.

c. Source Limitations: Furnish supports, associated fittings, accessories, and hardware produced by single manufacturer.

2.6 ANCHORS AND FASTENERS

A. Manufacturers - Mechanical Anchors:

1. FNW; 7502: www.fnw.com/#sle.

2. Hilti, Inc: www.us.hilti.com/#sle.

3. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com/#sle.

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4. MKT Fastening: www.mktfasteningusa.com/#sle.
5. Powers Fasteners, Inc: www.powers.com/#sle.
6. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.

B. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

C. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.

D. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.

E. Hollow Masonry: Use toggle bolts.

F. Hollow Stud Walls: Use toggle bolts.

G. Steel: Use beam ceiling clamps, beam clamps, machine bolts, or welded threaded studs.

H. Beam Ceiling Flanges: ASTM A47/A47M Grade 32510, malleable iron or stainless steel with copper, plain, stainless steel, or zinc finish.

I. Sheet Metal: Use sheet metal screws.

J. Wood: Use wood screws.

K. Plastic and lead anchors are not permitted.

L. Powder-actuated fasteners are not permitted.

M. Preset Concrete Inserts: Continuous metal strut channel and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.

1. Channel Material: Use galvanized steel.
2. Manufacturer: Same as manufacturer of metal strut channel framing system.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

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

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B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

D. Unless specifically indicated or approved by Engineer, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Engineer, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

H. Equipment Support and Attachment:

1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.

2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.

3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.

4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

I. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.

J. Secure fasteners according to manufacturer's recommended torque settings.

K. Remove temporary supports.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 22 05 29

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SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

D. Underground warning tape.

1.2 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting: Identification painting.

1.3 REFERENCE STANDARDS

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

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2025.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Schedules:

1. Submit plumbing component identification schedule listing equipment, piping, and valves.
2. Detail proposed component identification data in terms of of wording, symbols, letter size, and color coding to be applied to corresponding product.
3. Valve Data Format: Include id-number, location, function, and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

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PART 2 PRODUCTS

2.1 PLUMBING COMPONENT IDENTIFICATION GUIDELINE

A. Nameplates:

1. Heat exchangers, water heaters, and other heat transfer products.
2. Control panels, transducers, and other related control equipment products.
3. Pumps, tanks, filters, water treatment devices, and other plumbing equipment products.

B. Tags:

1. Piping: 3/4 inch diameter and smaller.
2. Manual operated and automated control valves.
3. Instrumentation, relays, gauges, and other related control equipment products.

C. Pipe Markers: 3/4 inch diameter and higher.

2.2 NAMEPLATES

A. Manufacturers:

1. Brimar Industries, Inc: www.pipemarker.com/#sle.
2. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
3. Seton Identification Products: www.seton.com/#sle.

B. Description: Laminated piece with up to three lines of text.

1. Letter Color: White.
2. Letter Height: 1/4 inch.

2.3 TAGS

A. Manufacturers:

1. Advanced Graphic Engraving: www.advancedgraphicengraving.com/#sle.
2. Brady Corporation: www.bradycorp.com/#sle.
3. Brimar Industries, Inc: www.pipemarker.com/#sle.
4. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
5. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.

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6. Seton Identification Products: www.seton.com/#sle.

B. Metal: Brass, 19 gauge 1-1/2 inch in diameter with smooth edges, blank, smooth edges, and corrosion-resistant ball chain. Up to three lines of text.

C. Valve Tag Chart: Typewritten 12-point letter size list in anodized aluminum frame.

D. Piping: 3/4 inch diameter and smaller. Include corrosion resistant chain. Identify service, flow direction, and pressure.

2.4 PIPE MARKERS

A. Manufacturers:

1. Brady Corporation: www.bradycorp.com/#sle.
2. Brimar Industries, Inc: www.pipemarker.com/#sle.
3. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
5. Seton Identification Products: www.seton.com/#sle.

B. Comply with ASME A13.1.

C. Flexible Marker: Factory fabricated, semi-rigid, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid conveyed.

D. Flexible Tape Marker: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.

E. Underground Flexible Marker: Bright-colored continuously printed ribbon tape, minimum 6 inches wide by 4 mil, 0.004 inch thick, manufactured for direct burial service.

F. Identification Scheme, ASME A13.1:

1. Primary: External Pipe Diameter, Uninsulated or Insulated.
    a. 3/4 to 1-1/4 inches: Use 8 inch field-length with 1/2 inch text height.
    b. 1-1/2 to 2 inches: Use 8 inch field-length with 3/4 inch text height.
2. Secondary: Color scheme per fluid service.
    a. Combustible Fluids: White text on brown background.
    b. Compressed Air: White text on blue background.
    c. Flammable and Oxidizing Fluids: Black text on yellow background.
    d. Toxic and Corrosive Fluids: Black text on orange background.
    e. Water; Potable, Cooling, Boiler Feed, and Other: White text on green background.

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2.5 UNDERGROUND WARNING TAPE

A. Manufacturers:

1. Brady Corporation: www.bradyid.com/#sle.
2. Brimar Industries, Inc: www.brimar.com/#sle.
3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
4. Seton Identification Products: www.seton.com/#sle.

B. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

1. Exception: Use foil-backed detectable type tape where required by serving utility or where directed by Owner.

C. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil, 0.004 inch.

D. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, 0.005 inch, unless otherwise required for proper detection.

E. Legend: Type of service, continuously repeated over full length of tape.

F. Color:

1. Tape for Buried Power Lines: Black text on red background.
2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive identification products.

B. Prepare surfaces for stencil painting, see Section 09 91 23.

3.2 INSTALLATION

A. Install flexible nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags in clear view and align with axis of piping

C. Apply stencil painted identification in compliance with Section 09 91 23 requirements. Identify unit with assigned id-number and area being served using pipe marking rules.

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D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Install plastic tape pipe marker around pipe in accordance with manufacturer's instructions.

F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

G. Apply ASME A13.1 Pipe Marking Rules:

1. Place pipe marker adjacent to changes in direction.
2. Place pipe marker adjacent each valve port and flange end.
3. Place pipe marker at both sides of floor and wall penetrations.
4. Place pipe marker every 25 to 50 feet interval of straight run.

H. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 22 05 53

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SECTION 22 07 19 - PLUMBING PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Glass fiber insulation.

B. Jacketing and accessories.

1.2 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 22 10 05 - Plumbing Piping: Placement of hangers and hanger inserts.

1.3 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2024).

C. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.

D. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

F. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

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B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.5 QUALITY ASSURANCE

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

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum 3 years of experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.7 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER INSULATION

A. Manufacturers:

1. CertainTeed Corporation: www.certainteed.com/#sle.
2. Johns Manville Corporation: www.jm.com/#sle.
3. Knauf Insulation: www.knaufinsulation.com/#sle.

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4. Manson Insulation, a company of Knauf Insulation: www.imanson.com/#sle.
5. Owens Corning Corporation: www.owenscorning.com/en-us/#sle.

B. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm.

C. Vapor Barrier Lap Adhesive: Compatible with insulation.

D. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

E. Indoor Vapor Barrier Finish:

1. Vinyl emulsion type acrylic, compatible with insulation, white color.

2.3 JACKETING AND ACCESSORIES

A. PVC Plastic Jacket:

1. Manufacturers:
    a. Johns Manville Corporation; ____: www.jm.com/#sle.
2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
    a. Minimum Service Temperature: 0 degrees F.
    b. Maximum Service Temperature: 150 degrees F.
    c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
    d. Thickness: 10 mil, 0.010 inch.
    e. Connections: Brush on welding adhesive.
3. Covering Adhesive Mastic: Compatible with insulation.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

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B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:

1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.

2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

G. Glass fiber insulated pipes conveying fluids above ambient temperature:

1. Provide standard jackets, with vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.

2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

H. Inserts and Shields:

1. Application: Piping 1-1/2 inches diameter or larger.

2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.

3. Insert Location: Between support shield and piping and under the finish jacket.

4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.

5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 07 84 00.

J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with canvas jacket sized for finish painting.

K. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

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3.3 SCHEDULES

A. Plumbing Systems:

1. Domestic Hot Water Supply:
    a. Glass Fiber Insulation:
        1) Thickness: ~~[2] inch~~1 inch.
2. Domestic Hot Water Recirculation:
    a. Glass Fiber Insulation:
        1) Thickness: ~~[2 inch]~~1 inch.
3. Domestic Cold Water: ~~2~~1" Glass Fiber Insulation
4. Roof Drain Bodies: ~~2~~1" Glass Fiber Insulation
5. Roof Drainage Above Grade: ~~2~~1" Glass Fiber Insulation
6. Roof Drainage Piping ~~2~~1" Glass Fiber Insulation
7. Storm Piping: ~~2~~1" Glass Fiber Insulation
8. Plumbing Vents Within 10 Feet of the Exterior: ~~2~~1" Glass Fiber Insulation

END OF SECTION 22 07 19

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SECTION 22 10 05 - PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Sanitary waste piping, buried within 5 feet of building.

B. Sanitary waste piping, above grade.

C. Domestic water piping, above grade.

D. Storm drainage piping, buried within 5 feet of building.

E. Storm drainage piping, above grade.

1.2 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 08 31 00 - Access Doors and Panels.

C. Section 09 91 13 - Exterior Painting.

D. Section 09 91 23 - Interior Painting.

E. Section 22 05 16 - Expansion Fittings and Loops for Plumbing Piping.

F. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment.

G. Section 22 05 53 - Identification for Plumbing Piping and Equipment.

H. Section 22 07 19 - Plumbing Piping Insulation.

I. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

J. Section 33 01 10.58 - Disinfection of Water Utility Piping Systems.

1.3 REFERENCE STANDARDS

A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

C. ASME B16.51 - Copper and Copper Alloy Press-Connect Pressure Fittings; 2021.

D. ASME B31.9 - Building Services Piping; 2025.

E. ASTM B32 - Standard Specification for Solder Metal; 2020.

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F. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

G. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

H. ASTM B813 - Standard Specification for Water Flushable Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2024.

I. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2023.

J. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2020 (Reapproved 2024).

K. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2025.

L. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2020 (Reapproved 2024).

M. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2024, with Editorial Revision (2025).

N. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

O. AWWA C651 - Disinfecting Water Mains; 2023.

P. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2021.

Q. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2020.

R. IAPMO (UPC) - Uniform Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

S. IAPMO/ANSI/CAN Z1117 - Standard for Press Connections; 2022.

T. ICC (IPC) - International Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

U. NSF 61 - Drinking Water System Components - Health Effects; 2024.

V. NSF 372 - Drinking Water System Components - Lead Content; 2024.

W. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

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1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.

D. Project Record Documents: Record actual locations of valves.

E. Maintenance Materials: Furnish the following for CPL's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements for additional provisions.

2. Valve Repacking Kits: One for each type and size of valve.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.7 FIELD CONDITIONS

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

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PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, solder, and flux (if used), complying with NSF 61 and NSF 372; label pipe and fittings.

B. Plenum-Installed Piping: Provide piping with flame spread index of 25 or less and smoke developed index of 50 or less when tested in accordance with ASTM E84 or UL 723.

2.2 SANITARY WASTE PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. PVC Pipe: ASTM D2665 or ASTM D3034.

1. Fittings: PVC.
2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.3 SANITARY WASTE PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.

1. Fittings: Cast iron.
2. Joints: CISPI 310, neoprene gaskets and stainless steel extra heavy duty clamp-and-shield assemblies.

2.4 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Pipe: ASTM B88 (ASTM B88M), Type L, drawn temper.

1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
2. Joints: ASTM B32 solder.
3. Mechanical Press Sealed Fittings: ASME B16.51 or IAPMO/ANSI/CAN Z1117, ICC (IPC), and IAPMO (UPC) approved, NSF 61 and NSF 372 certified, with EPDM seals.
    a. Manufacturers:
        1) Anvil International; _____: www.anvilintl.com/#sle.
        2) Apollo Valves; _____: www.apollovalves.com/#sle.
        3) Bonomi North America, Inc; BONOMI PRESS: www.bonominorthamerica.com/#sle.

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4) FNW; Copper Press: www.fnw.com/#sle.

5) NIBCO INC; Press System: www.nibco.com/#sle.

2.5 STORM DRAINAGE PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. PVC Pipe: ASTM D2665 or ASTM D3034.

1. Fittings: PVC.

2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.6 STORM DRAINAGE PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.

1. Fittings: Cast iron.

2. Joints: Neoprene gaskets and extra heavy duty stainless steel clamp-and-shield assemblies.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

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D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. See Section 22 05 16.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

   1. See Section 22 07 19.

H. Provide access where valves and fittings are not exposed.

   1. Coordinate size and location of access doors with Section 08 31 00.

I. Establish elevations of buried piping outside the building to ensure not less than 4 ft of cover.

J. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.

K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.

L. Provide support for utility meters in accordance with requirements of utility companies.

M. Prepare exposed, unfinished pipe, fittings, supports, and accessories for finish painting.

   1. See Section 09 91 23 for painting of interior plumbing systems and components.

   2. See Section 09 91 13 for painting of exterior plumbing systems and components.

N. Install valves with stems upright or horizontal, not inverted. See Section 22 05 23.

O. Install water piping to ASME B31.9.

P. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

Q. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

R. Sleeve pipes passing through partitions, walls, and floors.

S. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.4 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

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C. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

D. Install globe valves for throttling, bypass, or manual flow control services.

E. Provide spring-loaded check valves on discharge of water pumps.

F. Provide flow controls in water recirculating systems at each return branch take off.

3.5 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope.

B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.6 FIELD TESTS AND INSPECTIONS

A. Verify and inspect systems according to requirements by the Authority Having Jurisdiction. In the absence of specific test and inspection procedures proceed as indicated below.

B. Domestic Water Systems:

1. Perform hydrostatic testing for leakage prior to system disinfection.
2. Test Preparation: Close each fixture valve or disconnect and cap each connected fixture.
3. General:
    a. Fill the system with water and raise static head to 10 psi above service pressure. Minimum static head of 50 to 150 psi. As an exception, certain codes allow a maximum static pressure of 80 psi.
4. Metal Piping Systems Subject to Freezing Conditions:
    a. Inject 40 psi of compressed air into piping to spot check for leaks with liquid soap. Document and repair leaks as necessary.
    b. Raise injected compressed air pressure to 1.5 times rated service pressure or minimum pressure of 100 psi for a duration of 2 hours and verify with a gauge that no perceptible pressure drop is measured.

C. Gas Distribution Systems:

1. Test Preparation: Close each appliance valve or disconnect and cap each connected appliance.
2. General Systems:
    a. Inject a minimum of 10 psi of compressed air into the piping system for a duration of 15 minutes and verify with a gauge that no perceptible pressure drop is measured.

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b. Ensure test pressure gauge has a range of twice the specific pressure rate selected with an accuracy of 1/10 of 1 pound.

D. Test Results: Document and certify successful results, otherwise repair, document, and retest.

3.7 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect water distribution system in accordance with Section 33 01 10.58.

B. Prior to starting work, verify system is complete, flushed, and clean.

C. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

D. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.

E. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

F. Maintain disinfectant in system for 24 hours.

G. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

H. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

I. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.8 SERVICE CONNECTIONS

A. Provide new sanitary and storm sewer services. Before commencing work, check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

END OF SECTION 22 10 05

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SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Backflow preventers.

B. Vacuum breakers.

C. Water pressure reducing valves.

D. Mixing valves.

E. Balancing valves.

F. Strainers.

G. Hose bibbs.

H. Hydrants.

I. Water-hammer arrestors.

J. Trap primers.

1.2 RELATED REQUIREMENTS

A. Section 22 05 19 - Meters and Gauges for Plumbing Piping: Thermometers, pressure gauges, and water meters.

B. Section 22 10 05 - Plumbing Piping: Pipe, fittings, and joints.

C. Section 26 05 83 - Wiring Connections.

1.3 ABBREVIATIONS AND ACRONYMS

A. DZR: Dezincification resistant.

B. FDA: United States Food and Drug Administration.

C. OS&Y: Outside stem and yoke.

D. NRS: Non-rising stem.

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1.4 REFERENCE STANDARDS

A. ASSE 1001 - Performance Requirements for Atmospheric Type Vacuum Breakers; 2021.

B. ASSE 1003 - Water Pressure Reducing Valves for Potable Water Distribution Systems; 2023.

C. ASSE 1010 - Performance Requirements for Water Hammer Arresters; 2021.

D. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers; 2023.

E. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Prevention Assemblies; 2021.

F. ASSE 1017 - Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems; 2023.

G. ASSE 1044 - Performance Requirements for Trap Seal Primer - Drainage Types and Electric Design Types; 2023.

H. AWWA C511 - Reduced-Pressure Principle Backflow Prevention Assembly; 2017 (Reaffirmed 2021).

I. NSF 61 - Drinking Water System Components - Health Effects; 2024.

J. NSF 372 - Drinking Water System Components - Lead Content; 2024.

K. PDI-WH 201 - Water Hammer Arresters; 2017.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's literature and data sheets for each product. Include information on materials of fabrication, assembly of components, dimensions, ratings, finishes, rough-in requirements, and installed accessories.

C. Manufacturer's Instructions.

D. Operation and Maintenance Data.

E. Executed warranty.

F. Project Record Documents.

1. For each trap primer and trap primer system, provide documentation or field photographs of installed sub-slab piping.

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1.6 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

B. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

C. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

D. Store products under cover and protected from weather and dirt. Elevate above grade.

E. Protect end connections, flanges, threads, and grooves from dirt and damage.

F. Protect product interiors against rust and corrosion.

G. Do not use operating handles or stems as lifting or rigging points.

H. Handle large products using slings.

1.7 WARRANTY

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

B. Manufacturer Warranty:

1. Digitally Controlled Thermostatic Master Mixing Valves: Provide 5-year manufacturer warranty. Complete forms in CPL's name and register with manufacturer.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products complying with NSF 61 and NSF 372.

B. Source Limitations: Furnish domestic water piping specialties of same kind by same manufacturer.

C. Provide brass-bodied domestic water piping specialties in DZR brass.

2.2 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers:

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a. MIFAB, Inc: www.mifab.com/#sle.

b. Zurn Industries, LLC: www.zurn.com/#sle.

c. Watts.

2. NPS 2 and Smaller:

a. Assembly: ASSE 1013 and AWWA C511.

b. Backflow Valve: Manufactured from bronze, copper silicon alloy, or stainless steel.

c. Isolation Valves: Ball valves on inlet and outlet.

d. Maximum Working Pressure: 175 psi.

e. Working Temperature Range: 33 to 180 degrees F.

f. Accessories:

1) Air gap fitting.

2) Inlet strainer.

2.3 VACUUM BREAKERS

A. Atmospheric Vacuum Breakers:

1. Manufacturers:

a. Cash Acme, a brand of Reliance Worldwide Corporation: www.cashacme.com/#sle.

2. Valve: ASSE 1001, brass, bronze, or copper silicon alloy.

3. Maximum Working Pressure: 125 psi.

4. Working Temperature Range: 33 to 180 degrees F.

2.4 WATER PRESSURE REDUCING VALVES

A. Direct-Acting Pressure Reducing Valves:

1. Manufacturers:

a. Cash Acme, a brand of Reliance Worldwide Corporation: www.cashacme.com/#sle.

b. Flomatic Valves: www.flomatic.com/#sle.

c. Zurn Industries, LLC: www.zurn.com/#sle.

2. Valve: ASSE 1003, bronze or copper silicon alloy body, with spring-loaded diaphragm; field-adjustable outlet pressure, and integral inlet screen strainer.

a. Diaphragm: EPDM or buna-nitrile.

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b. Spring: Stainless steel.

3. Maximum Working Pressure: 300 psi.

4. Outlet Pressure Range: 15 to 75 psi.

5. Working Temperature Range: 33 to 140 degrees F.

2.5 MIXING VALVES

A. Thermostatic Master Mixing Valves:

1. Manufacturers:

a. Cash Acme, a brand of Reliance Worldwide Corporation: www.cashacme.com/#sle.

b. Holby Valve, Inc: www.holby.com/#sle.

c. Lawler.

2. Valve: ASSE 1017, brass or bronze body; thermostatic element; corrosion- and lime-resistant internal components; integral locking temperature adjustment.

3. Accessories:

a. Check valves with external strainers on inlets.

b. Shut-off valve on inlets and outlet.

c. Stem thermometer on inlets and outlet.

4. Cabinet: Stainless steel, for surface mounting with hinged locking access door.

2.6 BALANCING VALVES

A. Manual Balancing Valves:

1. Manufacturers:

a. NIBCO INC: www.nibco.com/#sle.

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

2. Valve: Brass, ball or globe valve design, with metering ports, position indicator, and memory stop.

3. Maximum Working Pressure: 150 psi.

4. Working Temperature Range: 33 to 200 degrees F.

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2.7 STRAINERS

A. Manufacturers:

1. NIBCO INC: www.nibco.com/#sle.
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. NPS 2 and Smaller:

1. Body: Wye-pattern in brass, bronze, or copper silicon alloy.
2. Screen: Stainless steel mesh.
3. Pressure Rating: 200 psi.

2.8 HOSE BIBBS

A. Manufacturers:

1. Effebi; Sky: www.effebi.com/#sle.
2. Zurn.
3. Chicago.
4. Nibco.
5. Watts.

B. Hose Bibbs:

1. Valve: Bronze or brass body with mounting flange, replaceable seat, hose thread spout, and integral or add-on vacuum breaker complying with ASSE 1011.
2. Operation:
    a. Exposed Locations in Finished Areas: Loose key.
3. Finishes:
    a. Exposed Locations in Finished Areas: Provide in polished chrome or polished brass.
    b. Service Areas: Provide in polished chrome or rough chrome.
4. Maximum Working Pressure: 125 psi.
5. Working Temperature Range: 33 to 120 degrees F.

2.9 WATER-HAMMER ARRESTORS

A. Manufacturers:

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1. Zurn Industries, LLC: www.zurn.com/#sle.

B. Piston Type:

1. Description: ASSE 1010 or PDI-WH 201, copper body with plastic piston and EPDM O-rings.
2. Air Preload Pressure: 60 psi.
3. Maximum Working Pressure: 150 psi.
4. Working Temperature Range: 33 to 180 degrees F.

2.10 TRAP PRIMERS

A. Electronic Trap Primer Systems:

1. Manufacturers:
   a. MIFAB, Inc: www.mifab.com/#sle.
   b. Zurn Industries, LLC: www.zurn.com/#sle.
2. Description: ASSE 1044, packaged electronic trap primer system; factory piped and wired, with timer-controller, slow-acting solenoid, strainer, isolation valve, vacuum breaker, and distribution manifold.
3. Operating Pressure Range: 20 to 100 psi.
4. Minimum Outlet Ports on Distribution Manifold: Five outlet ports.
5. Cabinet:
   a. Material: Galvanized steel.
   b. Mounting: Recessed.
   c. Cover: In same material as body of cabinet.
   d. Provide cover with hinged, locking access door.
6. Electrical Characteristics:
   a. Hardwired: 120 VAC at 60 Hz.
      1) See Section 26 05 83 for electrical connections.
7. Products:
   a. MIFAB, Inc; MI-100: www.mifab.com/#sle.
   b. Zurn Industries, LLC; Z1020XL: www.zurn.com/#sle.

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PART 3 EXECUTION

3.1 EXAMINATION

A. Discard packing materials and verify product interiors are free from debris, damage, and corrosion.

B. Verify end connections, flanges, threads, and grooves are completely clean without signs of damage or degradation that could result in leakage.

C. For products containing isolation or shutoff valves, verify isolation and shutoff valves operate smoothly from fully closed to fully open.

3.2 INSTALLATION

A. Prior to installation of domestic water piping specialties, flush domestic water piping of foreign material.

B. Install products in accordance with manufacturer's instructions.

C. Install products level and plumb.

D. Install products with clearance for access and maintenance.

E. Support products NPS 2-1/2 and larger independently of surrounding pipe.

F. Support products with flanged or grooved ends independently of surrounding pipe.

G. For products containing isolation or shutoff valves, locate valves in horizontal piping with stems at or above center of piping, maintaining unimpeded stem movement.

H. Backflow Preventers:

1. Install backflow preventers in accordance with requirements of local authorities having jurisdiction, including requirements of local water utility.

2. Pipe relief from reduced-pressure-principle backflow preventers to nearest drain.

I. Water Pressure Reducing Valves:

1. Install shutoff valves on inlet and outlet.

2. Install pressure gauges on inlet and outlet.

J. Thermostatic Master Mixing Valves: Install at all sinks and lavatories.

K. Install master thermostatic mixing valve in mechanical room.

L. Balancing Valves: Install in accessible locations. Install shutoff valves on inlet and outlet.

M. Water Hammer Arrestors: Install in accordance with PDI-WH 201.

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N. Trap Primers:

1. Install trap primers minimum of 12 inches above flood level of highest drain being served.
2. Unless noted otherwise on drawings, install electronic trap primer systems with manifold above ceiling.
3. Check that water flows through piping and that there are no leaks before pouring slabs or closing in walls.
4. Cap unused ports on distribution manifold.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Inspect each product for damage and defects.

C. Repair or replace damaged products.

D. Replace defective products.

E. For products containing isolation or shutoff valves, exercise isolation and shutoff valves from fully closed to fully open. Confirm smooth operation.

F. Backflow Preventers:

1. Test in accordance with manufacturer's instructions.
2. Test in accordance with requirements of authorities having jurisdiction.
3. Test in accordance with ASSE listing of backflow preventer.
4. Replace backflow preventers that fail testing.

G. Vacuum Breakers:

1. Test in accordance with manufacturer's instructions.
2. Test in accordance with requirements of authorities having jurisdiction.
3. Test in accordance with ASSE listing of vacuum breaker.
4. Replace vacuum breakers that fail testing.

H. Water Pressure Reducing Valves: Confirm outlet pressure remains steady without fluctuation.

I. Mixing Valves: Confirm outlet temperature remains steady without fluctuation.

J. Electronic Trap Primer Systems:

1. Clean strainer.
2. Test system following manufacturer's instructions.

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3. Visually confirm that water has reached each drain and that traps are full of water.
4. Operate system until each trap is full.

K. Coordination of Other Tests and Inspections: Provide access to accommodate tests and inspections by independent testing agencies employed by CPL.

3.4 SYSTEM STARTUP

A. Manufacturer Services: Provide services of manufacturer's field representative to perform startup for the following:
1. Electronic trap primer systems.

B. Prepare and start products, equipment, and systems in accordance with manufacturers' instructions and recommendations.

3.5 ADJUSTING

A. Adjust pressure reducing valves to design pressure set point.

B. Adjust mixing valves to design temperature set point.

C. Adjust balancing valves to design flow.

D. Adjust thermostatic balancing valves to design temperature setpoint.

E. Adjust electronic trap primers to design flow.

3.6 CLEANING

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

B. Clean products to remove dirt, paint, and other foreign materials.

C. Clean surfaces of products exposed to view in finished spaces to remove dirt, fingerprints, paint, and other foreign materials. Restore finishes to match original factory finish.

D. Clean surfaces of products exposed to view on building exterior to remove dirt, fingerprints, paint, and other foreign materials. Restore finishes to match original factory finish.

E. Remove debris and clean interiors of equipment cabinets.

F. Clean strainers, including those internal to other products, prior to mm-dd-yyyy.

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3.7 CLOSEOUT ACTIVITIES

A. Demonstrate operation, adjusting, and maintenance of the following to CPL's designated personnel.

1. Digitally controlled thermostatic master mixing valves.
2. Electronic trap primer systems.

3.8 PROTECTION

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

END OF SECTION 22 11 19

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SECTION 22 11 23 - DOMESTIC WATER PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Circulators.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

A. ICC (IPC) - International Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. NSF 61 - Drinking Water System Components - Health Effects; 2024.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data:

1. Provide certified pump curve with duty point marked over pump and system operating conditions and NPSH curve and power requirement by pump tag.

2. Manufacturer's catalog sheets for fixtures, fittings, accessories, and supplies.

C. Shop Drawings: Include dimensions and performance data.

D. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

E. Executed warranty.

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in CPL's name and registered with manufacturer.

G. Maintenance Materials: Furnish the following for CPL's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements for additional provisions.

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1.5 QUALITY ASSURANCE

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

B. Certifications: Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc, as suitable for purpose specified and indicated.

C. Identification: Provide pumps with manufacturer's name, model number, and rated capacity identified by permanently attached label.

D. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.7 WARRANTY

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

B. Manufacturer Warranty: Provide 5-year manufacturer warranty for circulators. Complete forms in CPL's name and register with manufacturer.

PART 2 PRODUCTS

2.1 CIRCULATORS

A. Manufacturers:

1. Armstrong Fluid Technology; _____: www.armstrongfluidtechnology.com/#sle.
2. Bell & Gossett, a Brand of Xylem, Inc; _____: www.xylem.com/#sle.
3. Grundfos Pumps Corporation; MAGNA 3: www.grundfos.com/#sle.

B. Casing: Bronze with bronze cast impeller, and stainless steel rotor assembly.

C. Shaft: Alloy steel with integral thrust collar and two oil-lubricated bronze sleeve bearings.

D. Mechanical Seal: Carbon rotating against a stationary ceramic seat.

E. Pipe-End Connection: Union connection.

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F. Maximum Discharge Pressure: 145 psi.

G. Minimum Inlet Pressure: 0.5 psi at 140 degrees F.

H. Motor: 1,750 rpm, ECM duty with flexible coupling.

I. Service Temperature Range: Minus 30 to 250 degrees F.

J. Controls: Provide aquastat set for high-temp cutoff, electric plug, and illuminated hand switch.

K. Accessories: Include inlet-outlet temperature and pressure gauges with 2-way isolation valves.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install products with related fittings, and accessories according to manufacturer instructions.

B. Potable and Drinking Water Service: Provide NSF 61 certified; comply with ICC (IPC).

C. Electrical-Driven Pump Work:

1. Provide electric-motor-driven equipment specified complete with local disconnect switch and control panel with starter, controls, safety devices, and related wiring.

2. Provide automatic control and protective devices field-wired to interface-related devices required for specified operation.

D. Ensure that small pressure gauges are installed on both upstream and downstream ends.

E. Hot Water Service: Ensure that small pressure-temperature gauges are installed on both upstream and downstream ends.

F. Factory-Provided Pump Controls: Factory provided, tested for use.

G. Cycle Duty Controlled Pumps: Set manually to ON for continuous operation.

H. ECM, VSD, or VFD Controlled Motors: Configure unit to operate within manufacturer-listed pump curve points unless factory set to do so. Then adjust to operate in automatic to maintain downstream pressure setpoint.

I. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are nonoverloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

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3.2 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Operational Tests: Upon completion and sterilization of plumbing systems, conduct operating tests to demonstrate satisfactory, functional, and operating efficiency.

3.3 CLEANING

A. Thoroughly clean plumbing fixtures and equipment.

3.4 PROTECTION

A. Protect installed products from damage due from subsequent construction operations.

B. Repair or replace products damaged before Date of Substantial Completion.

END OF SECTION 22 11 23

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SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Floor drains.

B. Floor sinks.

C. Cleanouts.

D. Backwater valves.

1.2 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping.

B. Section 22 11 19 - Domestic Water Piping Specialties: Trap primers.

1.3 REFERENCE STANDARDS

A. ASME A112.6.3 - Floor Drains; 2022.

B. ASME A112.6.7 - Sanitary Floor Sinks; 2022.

C. ASME A112.14.1 - Backwater Valves; 2003 (Reaffirmed 2022).

D. ASME A112.36.2 - Cleanouts; 2022.

E. NSF 14 - Plastics Piping System Components and Related Materials; 2023.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's literature and data sheets for each product. Include information on fabrication materials, assembly of components, dimensions, ratings, finishes, rough-in requirements, and installed accessories.

C. Shop Drawings:

D. Manufacturer's Instructions: Provide for products listed below. Include instructions for handling, protection, examination, preparation, and installation.

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1.5 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

B. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

C. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

D. Store products under cover and protected from weather and dirt. Elevate above grade.

E. Store plastic products protected from direct sunlight.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Plastic Sanitary Waste Piping Specialties: Provide plastic products that comply with NSF 14.

B. Source Limitations: Furnish drains and sanitary waste piping specialties of same kind by same manufacturer.

2.2 FLOOR DRAINS

A. Cast Iron Floor Drains:

1. Manufacturers:

a. MIFAB, Inc: www.mifab.com/#sle.

b. Zurn Industries, LLC: www.zurn.com/#sle.

c. ~~JR Smith~~Jay R Smith; 2005Y: www.jrsmith.com/#sle..

2. Assembly: ASME A112.6.3.

3. Body: Lacquered cast iron with anchor flange and membrane clamping collar with weepholes.

4. Strainer: Adjustable, removable, with vandal-proof screws.

a. Square:

1) Material: Stainless steel.

2) Size: 6 by 6 inches.

5. Accessories:

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a. Trap primer plug.

2.3 FLOOR SINKS

A. Cast Iron Floor Sinks:

1. Manufacturers:

a. MIFAB, Inc: www.mifab.com/#sle.

b. Zurn Industries, LLC: www.zurn.com/#sle.

c. Jay R Smith; 325-Y04: www.jrsmith.com/#sle.

2. Assembly: ASME A112.6.7.

3. Body: Cast iron with white acid-resistant enameled interior and interior anti-splash dome strainer.

a. Square:

1) Size: 8 by 8 inches.

2) Sump Depth: 6 inches.

4. Clamping Flange: Provide anchor flange with membrane clamping collar.

5. Grate: Provide without grate.

2.4 CLEANOUTS

A. Manufacturers:

1. MIFAB, Inc: www.mifab.com/#sle.

2. Zurn Industries, LLC: www.zurn.com/#sle.

3. JR Smith.

B. Floor Cleanouts:

1. Assembly: ASME A112.36.2.

2. Body: Lacquered cast iron.

3. Closure Plug: PVC or ABS, threaded, gastight and watertight.

4. Top: Adjustable, with vandal-proof screws.

a. Shape and Finish:

1) All Locations, Unless Noted Otherwise: Square; stainless steel.

C. Wall Cleanouts:

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1. Assembly: ASME A112.36.2.
2. Body: Tee type; body material to match surrounding pipe.
3. Plug: Bronze, threaded, gastight.
4. Access Cover: Round, stainless steel wall access cover with vandal-proof screw.

2.5 BACKWATER VALVES

A. Manufacturers:
   1. Zurn Industries, LLC: www.zurn.com/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Cast Iron Backwater Valves:
   1. Assembly: ASME A112.14.1.
   2. Horizontal: Lacquered cast iron body, flapper valve, and bolted, gasketed access cover.
   3. Vertical and Floor Drain Outlet: Lacquered cast iron body, ball-type float, and replaceable seals.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

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

B. Maintain continuity of waterproofing membranes. Secure waterproofing membranes to drain clamping collars and bonding flanges.

C. Install drains so strainers and grates are level and are at design elevation.

D. Install floor sinks so grates are flush with finished floor unless noted otherwise or unless directed otherwise by adopted code.

E. Extend cleanouts to finished floor or wall surface. Ensure clearance at cleanout for rodding or jetting of drainage system.

F. Install floor cleanouts to allow for floor finishes.

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G. Locate, provide, and install cleanouts in piping in accordance with adopted code.

3.3 CLEANING

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

B. Clean debris from drains.

C. Clean grates and strainers prior to mm-dd-yyyy.

3.4 PROTECTION

A. Protect installed drains from accumulating dirt and debris through remainder of construction.

B. Protect installed products from damage due to subsequent construction operations.

END OF SECTION 22 13 19

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SECTION 22 14 23 - STORM DRAINAGE PIPING SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roof and exterior surface drains.

B. Downspout adaptors, boots, and nozzles.

C. Cleanouts.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

A. ASME A112.6.4 - Roof, Deck, and Balcony Drains; 2022.

B. ASME A112.36.2 - Cleanouts; 2022.

C. NSF 14 - Plastics Piping System Components and Related Materials; 2023.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's literature and data sheets for each product. Include information on fabrication materials, assembly of components, dimensions, ratings, finishes, rough-in requirements, and installed accessories.

C. Manufacturer's Instructions: Provide for products listed below. Include instructions for handling, protection, examination, preparation, and installation.

1.5 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

B. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

C. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

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D. Store products under cover and protected from weather and dirt. Elevate above grade.

E. Store plastic products protected from direct sunlight.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Plastic Storm Drainage Piping Specialties: Provide plastic products complying with NSF 14.

B. Source Limitations: Furnish drains and storm drainage piping specialties of same kind by same manufacturer.

2.2 ROOF AND EXTERIOR SURFACE DRAINS

A. Cast Iron Roof Drains and Overflow Roof Drains:

1. Manufacturers:
    a. MIFAB, Inc: www.mifab.com/#sle.
    b. Zurn Industries, LLC: www.zurn.com/#sle.
2. Assembly: ASME A112.6.4.
3. Body: Lacquered cast iron with membrane clamping ring with gravel stop.
4. Strainer: Removable thermoplastic polymer dome with vandal-proof screws.
5. Overflow Drains: Provide 2-inch high external overflow waterdam or internal standpipe extension.
6. Accessories:
    a. Adjustable, extendable collar.
    b. Roof sump receiver.
    c. Secondary flashing collar.
    d. Stainless steel ballast guard.
    e. Under-deck clamp.
7. Products:
    a. MIFAB, Inc; R1200 Large Sump Roof Drain: www.mifab.com/#sle.
    b. Zurn Industries, LLC; FROET 100C: www.zurn.com/#sle.
    c. Zurn Industries, LLC; Z100F: www.zurn.com/#sle.

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2.3 DOWNSPOUT ADAPTERS, BOOTS, AND NOZZLES

A. Downspout Adapters:

1. Description: Lacquered cast iron transition fitting to connect parapet drain to exterior rainwater downspout.

B. Downspout Boots:

1. Description: Lacquered cast iron transition fitting to connect exterior rainwater downspout to subgrade stormwater piping.
2. Height of Downspout Boot: 24 inches.

C. Downspout Nozzles, Metal:

1. Description: Cast bronze or nickel bronze wall-mounted fitting for terminating interior rainwater leader on building exterior, with anchor flange and decorative cow's tongue outlet.
    a. Provide with stainless steel bird screen.

2.4 CLEANOUTS

A. Manufacturers:

1. Zurn Industries, LLC: www.zurn.com/#sle.

B. Floor Cleanouts:

1. Assembly: ASME A112.36.2.
2. Body: Lacquered cast iron.
3. Closure Plug: PVC or ABS, threaded, gastight and watertight.
4. Top: Adjustable, with vandal-proof screws.
    a. Shape and Finish:
        1) All Locations, Unless Noted Otherwise: Square; stainless steel.
5. Accessories:
    a. Acid-resistant coating.

C. Wall Cleanouts:

1. Assembly: ASME A112.36.2.
2. Body: Tee type; body material to match surrounding pipe.
3. Plug: PVC or ABS, threaded, gastight.

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4. Access Cover: Round, stainless steel wall access cover with vandal-proof screw.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

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

B. Maintain continuity of waterproofing membranes. Secure waterproofing membranes to drain clamping collars.

C. Install roof drains at low points of roof areas.

D. Extend cleanouts to finished floor or wall surface. Ensure clearance at cleanout for rodding or jetting of drainage system.

E. Install floor cleanouts to allow for floor finishes.

F. Locate, provide, and install cleanouts in piping in accordance with adopted code.

G. Install downspout boots with top at minimum of 12 inches above finished grade.

3.3 CLEANING

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

B. Clean debris from drains.

C. Clean grates and strainers prior to mm-dd-yyyy.

3.4 PROTECTION

A. Protect installed drains from accumulating dirt and debris through remainder of construction.

B. Protect installed products from damage due to subsequent construction operations.

END OF SECTION 22 14 23

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SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flush valve water closets.

B. Wall hung urinals.

C. Lavatories.

D. Sinks.

E. Under-lavatory pipe supply covers.

F. Bi-level, electric water coolers.

G. Mop sinks.

1.2 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping.

B. Section 22 11 19 - Domestic Water Piping Specialties.

C. Section 22 30 00 - Plumbing Equipment.

D. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration; 2008 (Reaffirmed 2013).

C. ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2017).

D. ASME A112.18.1 - Plumbing Supply Fittings; 2024.

E. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures; 2011 (Reaffirmed 2022).

~~ASME A112.19.1 - Enamelled Cast Iron and Enamelled Steel Plumbing Fixtures; 2024.~~

F. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2024.

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G. ASME A112.19.3 - Stainless Steel Plumbing Fixtures; 2022.

H. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks; 2022.

I. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2020.

J. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

K. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

L. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2021.

M. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

N. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

O. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

P. NSF 61 - Drinking Water System Components - Health Effects; 2024.

Q. NSF 372 - Drinking Water System Components - Lead Content; 2024.

R. UL (DIR) - Online Certifications Directory; Current Edition.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's literature and data sheets for each product. Include materials of fabrication, rough-in requirements, location and sizes of connections, configurations, dimensions, finishes, features, and accessories.

1. For electrically powered fixtures, include electrical characteristics.

C. Manufacturer's Instructions: Indicate installation methods and procedures.

D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in CPL's name and registered with manufacturer.

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1.5 QUALITY ASSURANCE

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

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on-site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.7 WARRANTY

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

B. Provide five year manufacturer warranty for electric water cooler.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Potable Water Systems: Provide drinking water system components certified as complying with NSF 61 and NSF 372.

B. ADA: Where indicated to be ADA-compliant, provide fixtures complying with ADA Standards and ICC A117.1.

C. Water Efficiency: EPA WaterSense label is required for all water closets, urinals, and lavatory faucets.

D. Maximum Fixture Supply Pressure: 80 psi unless stated otherwise.

2.2 REGULATORY REQUIREMENTS

A. Comply with applicable codes for installation of plumbing systems.

B. Comply with UL (DIR) requirements.

C. Perform work in accordance with local health department regulations.

D. Provide certificate of compliance from Authority Having Jurisdiction indicating approval of installation.

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2.3 FLUSH VALVE WATER CLOSETS

A. Water Closets:

1. Vitreous china, ASME A112.19.2, wall hung, siphon jet flush action, china bolt caps.
2. Bowl: ASME A112.19.2; 16.5 inches high with elongated rim.
3. Flush Valve: Exposed (top spud).
4. Flush Operation: Manual, oscillating handle.
5. Handle Height: 44 inches or less.
6. Inlet Size: 1-1/2 inches.
7. Trapway Outlet: ~~4 inch~~2-1/8 inch.
8. Color: White.
9. Manufacturers:
   a. American Standard~~[<>]~~; 3351.101: www.americanstandard-us.com/#sle
   b. Kohler Company: www.kohler.com/#sle.
   c. Mansfield Plumbing Products LLC: www.mansfieldplumbing.com/#sle.
   d. Zurn Industries, LLC: www.zurn.com/#sle.

B. Flush Valves:

1. Valve Supply Size: 1 inch.
2. Valve Outlet Size: 1-1/2 inches.
3. Manufacturers:
   a. Sloan Valve Company~~[<>]~~; 111-1.6-CP: www.sloanvalve.com/#sle.
   b. Zurn Industries, LLC~~; ZEMS Series~~: www.zurn.com/#sle.

      ~~Chicago.~~
4. Manual Operated:
   a. Type: ASME A112.18.1 or ASME A112.19.5; diaphragm type complete with vacuum breaker stops, and accessories.
   b. Supplied Volume Capacity: ~~1.0 gal~~1.6 gal per flush.

C. Toilet Seats:

1. Manufacturers:
   a. Bemis Manufacturing Company: www.bemismfg.com/#sle.

      ~~Church Seat Company: www.churchseats.com/#sle.~~

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b. American Standard~~[<>]~~; 5901.100: www.americanstandard-us.com/#sle

c. Olsonite: www.olsonite.com/#sle.

d. PROFLO~~; Commercial - Baby Bowls, Open Front~~: www.ferguson.com/#sle.

e. Zurn Industries, LLC: www.zurn.com/#sle.

2. Plastic: Solid, white finish, enlongated shape, open front, and brass bolts with covers.

~~Plastic: Black finish, open front, extended back, self-sustaining hinge, brass bolts, with cover.~~

D. Water Closet Carriers:

1. Manufacturers:

a. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.

b. JOSAM Company: www.josam.com/#sle.

c. Zurn Industries, LLC; Z1201-N: www.zurn.com/#sle.

2. ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

~~**WALL HUNG URINALS**~~

~~Manufacturers:~~

~~American Standard: www.americanstandard-us.com/#sle~~

~~Kohler Company: www.kohler.com/#sle.~~

~~Mansfield Plumbing Products LLC: www.mansfieldplumbing.com/#sle.~~

~~Zurn Industries, LLC: www.zurn.com/#sle.~~

~~Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.~~

~~Consumption Volume: 1.0 gal per flush, maximum.~~

~~Flush Style: Washout.~~

~~Flush Valve: Exposed (top spud).~~

~~Flush Operation: Manual, oscillating handle.~~

~~Trapway Outlet: Integral.~~

~~Removable stainless steel strainer.~~

~~Supply Size: 3/4 inch.~~

~~Outlet Size and Location: 2 inches, bottom side.~~

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~~Flush Valves:~~

~~Manufacturers:~~

~~Sloan Valve Company: www.sloanvalve.com/#sle.~~

~~Zurn Industries, LLC; ZEMS Series: www.zurn.com/#sle.~~

~~Chicago.~~

~~Manual Operated:~~

~~Type: ASME A112.18.1 or ASME A112.19.5; diaphragm type, complete with vacuum breaker stops, and accessories.~~

~~Supplied Volume Capacity: .125 gal per flush.~~

~~Exposed Type: Chrome-plated, escutcheon, integral screwdriver stop.~~

~~Urinal Carriers:~~

~~Manufacturers:~~

~~Jay R. Smith Manufacturing Company; _____: www.jrsmith.com/#sle.~~

~~JOSAM Company; _____: www.josam.com/#sle.~~

~~Zurn Industries, LLC; Z1221: www.zurn.com/#sle.~~

~~ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.~~

2.4 LAVATORIES

A. Manufacturers:

1. Kohler Company: www.kohler.com/#sle.
2. Mansfield Plumbing Products LLC: www.mansfieldplumbing.com/#sle.
3. Zurn Industries, LLC: www.zurn.com/#sle.
4. American Standard~~[<>]~~; 0355.012 : www.americanstandard-us.com/#sle

B. Wall-Hung Basin:

~~Porcelain-Enamelled Cast Iron: ASME A112.19.1; white, rectangular basin with splash lip, front overflow, soap depression, and hanger. Size as indicated on drawings with 4-inch centerset spacing.~~

1. Vitreous China: ASME A112.19.2; white, rectangular commercial-grade sink with predrilled holes, rear-center drain, front overflow, and hanger. Size as indicated on drawings with 4-inch centerset spacing.

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2. Products:

a. American Standard; 0355.012: www.americanstandard-us.com/#sle.

3. Carrier:

a. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger, bearing plate and studs.

b. Manufacturers:

1) Jay R. Smith MFG. Co: www.jrsmith.com/#sle.

2) JOSAM Company: www.josam.com/#sle.

3) Zurn Industries, LLC; Z1231: www.zurn.com/#sle.

C. Supply Faucet:

1. Deck Mounted Faucet Manufacturers:

a. American Standard: www.americanstandard-us.com/#sle

b. Kohler Company: www.kohler.com/#sle.

c. Zurn Industries, LLC; Aqua Sense Series: www.zurn.com/#sle.

d. Delta Faucet Company; 86T0104: www.deltafaucet.com/#sle.

e. Chicago.

2. ASME A112.18.1; chrome plated combination supply fitting with open grid strainer, water economy aerator with maximum flow of 0.5 gpm, indexed handles.

D. Metered Faucet:

1. ASME A112.18.1; chrome plated metered mixing faucet with low voltage operated solenoid operator and infrared sensor, ~~aerator~~spray and cover plate, open grid strainer.

E. Thermostatic Mixing Valve:

1. ASSE 1070 water temperature limiting valve.

2. See Section 22 11 19 for mixing valve specifications.

F. Accessories:

1. Combination stop and strainer.

2. Chrome-plated 17 gauge, 0.0538 inch brass P-trap with clean-out plug, tailpiece, and escutcheon.

2.5 SINKS

A. Manufacturers:

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1. Kohler Company: www.kohler.com/#sle.
2. Elkay.
3. American Standard
4. PROFLO; PFSR252273A: www.ferguson.com/#sle.

B. Single Compartment Bowl

1. ASME A112.19.3; see drawings for size, ~~18 gauge, 0.050 inch~~20 gauge, 0.0375 inch thick, ~~type 316~~ stainless steel, self-rimming and undercoated, with ledge back drilled for trim.
2. Drain: ~~1-1/2 inch~~3-1/2 inch ~~chromed brass~~stainless steel.
3. See drawings for mounting.

C. Faucets:

1. Manufacturers:
   a. American Standard: www.americanstandard-us.com/#sle
   b. Kohler Company: www.kohler.com/#sle.
   c. ~~[Chicago]~~Cleveland Faucet Group; CA47511: www.cfgonline.com/#sle..
2. Single Handle Faucet:
   a. Type: Deck-mount, high-arc, swivel faucet with mounting plate.
   b. Spray Type: Full stream spray at 1.5 gpm, maximum.
   c. ASME A112.18.1, ADA Standards, and NSF 61 compliant assembly.
   d. Materials: Ceramic disc-cartridge valve on brass body with polished chrome finish.

D. Accessories: Provide braided water supply lines, slip-joint p-trap, and stainless steel basket strainer.

2.6 UNDER-LAVATORY PIPE SUPPLY COVERS

A. General:

1. Insulate exposed drainage piping including hot, cold and tempered water supplies under lavatories or sinks per ADA Standards.
2. Adhesives, sewing threads and two ply laminated materials are prohibited.
3. Exterior Surfaces: Smooth nonabsorbent with no finger recessed indentations for easy cleaning.
4. Construction: 1/8 inch PVC with antimicrobial, antifungal and UV resistant properties.

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a. Provide one piece injected molded design with internal bridge at top of J-bend to prevent separating.

b. Comply with ASTM E84 for flame and smoke development.

c. Comply with ASTM C1822 Type III for covers on accessible lavatory piping.

d. Comply with ASME A112.18.9 for covers on accessible lavatory piping.

e. Comply with ICC A117.1.

f. Thermal Resistance: R value of 0.504 or lower when tested by ASTM C177.

g. Thermal Conductivity: K value of 0.358 or density of 21.61 pcf per ASTM C518.

h. Microbial and Fungal Resistance for Interior and Exterior: Comply with ASTM G21.

5. Color: High gloss white.

6. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces. No cable ties allowed.

2.7 BI-LEVEL, ELECTRIC WATER COOLERS

A. Manufacturers:

1. Elkay Manufacturing Company~~;[_____]~~; LZSTL8WSLP: www.elkay.com/#sle.

2. Haws Corporation~~;[_____]~~: www.hawsco.com/#sle.

3. Oasis International~~;[_____]~~: www.oasiscoolers.com/#sle.

B. Water Cooler: Bi-level, electric, mechanically refrigerated; recessed, ADA compliant; stainless steel top, stainless steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting bracket; integral air cooled condenser and stainless steel grille.

1. Capacity: 8 gph of 50 degrees F water with inlet at 80 degrees F and room temperature of 90 degrees F, when tested in accordance with ASHRAE Std 18.

2. Electrical: 115 VAC, 60 Hertz compressor, 6 foot cord and plug for connection to electric wiring system including grounding connector.

3. Provide filter for waterline to drinking fountain / water cooler.

C. Bottle Filler: Materials to match fountain.

2.8 MOP SINKS

A. Manufacturers:

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1. Acorn Engineering Company~~;[_____]~~: www.acorneng.com/#sle.
2. American Bath Group~~;[_____]~~: www.americanbathgroup.com/#sle.
3. Just Manufacturing Company~~;[_____]~~: www.justmfg.com/#sle.
4. Zurn Industries, LLC~~;[_____]~~: www.zurn.com/#sle.
5. FIAT Products; MSB2424: www.fiatproducts.com/#sle.

~~Accessories:~~

~~5 feet of 1/2 inch diameter plain end reinforced plastic hose.~~

~~Hose clamp hanger.~~

~~Mop hanger.~~

~~Mop Sink Manufacturers:~~

~~Acorn Engineering Company; _____: www.acorneng.com/#sle.~~

~~American Bath Group; _____: www.americanbathgroup.com/#sle.~~

~~Just Manufacturing Company; _____: www.justmfg.com/#sle.~~

B. Material: ~~Precast terrazzo composed of marble chips cast in Portland cement~~Molded stone.

C. Type: Rectilinear, standard height.

D. Grid strainer: Stainless steel; integral; removable.

E. Dimensions: ~~As indicated on drawings~~As indicated in schedule.

F. Accessories:

1. 5 feet of 1/2 inch diameter plain end reinforced plastic hose.
2. Hose clamp hanger.
3. Mop hanger.

G. Faucet:

1. Manufacturers:
   a. Zurn; AquaSpec Z843M4-XL: www.zurn.com/#sle.
   b. Chicago Faucets: www.chicagofaucets.com/#sle.
   c. Kohler: www.kohler.com/#sle.
2. Cast brass sink faucet with 8 inch centers, polished chrome-plated finish, chemical resistant vacuum breaker, and 3/4" hose threaded outlet. Pale hood and adjustable wall brace included.

   ~~Accessories:~~

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PART 3 EXECUTION

3.1 EXAMINATION

A. Verify walls, floors, and finishes are prepared and ready for installation of fixtures.

B. Verify rough-ins for field connections match sizes and locations shown on drawings.

C. Verify electric power is available and of the correct characteristics.

D. Review casework and countertop shop drawings. Confirm locations and sizes of fixtures and openings before rough-in and installation.

E. Verify casework and countertops are prepared and ready for installation of fixtures.

3.2 INSTALLATION

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

B. Install components level and plumb.

C. Secure fixtures in place.

D. Install rigid or flexible supplies to fixtures. Provide supply stops, reducers, and escutcheons.

E. Install wall-mounted fixtures, trim, and accessories at heights indicated on drawings.

F. Install new batteries in battery-powered fixtures at time of Date of Substantial Completion.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Repair or replace damaged or defective products.

D. Test fixtures after installation to verify operation. Correct deficiencies.

3.4 ADJUSTING

A. Adjust stops and valves so fixtures operate without splashing, noise, or overflow.

3.5 CLEANING

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

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B. Clean plumbing fixtures to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.6 CLOSEOUT ACTIVITIES

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

3.7 PROTECTION

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

B. Do not permit use of fixtures by construction personnel.

END OF SECTION 22 40 00

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SECTION 23 01 30.51 - HVAC AIR-DISTRIBUTION SYSTEM CLEANING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cleaning of HVAC duct system, equipment, and related components.

1.2 RELATED REQUIREMENTS

A. Section 01 57 19 - Temporary Environmental Controls.

1.3 DEFINITIONS

A. HVAC System: For purposes of this section, the surfaces to be cleaned include all interior surfaces of the heating, air-conditioning and ventilation system from the points where the air enters the system to the points where the air is discharged from the system, including the inside of air distribution equipment, coils, and condensate drain pans; see NADCA ACR for more details.

1. Outdoor air system is required to be cleaned.
2. Relief / Exhaust-only system is required to be cleaned.

1.4 REFERENCE STANDARDS

A. NADCA ACR - The NADCA Standard for Assessment, Cleaning, and Restoration of HVAC Systems; 2025.

B. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

C. UL 181A - Closure Systems for Use with Rigid Air Ducts; Current Edition, Including All Revisions.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.

C. Qualifications Statement: Submit qualifications of proposed cleaning contractor for approval.

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D. Qualifications Statement: Submit qualifications of proposed testing and inspection agency for approval.

E. Project Cleanliness Evaluation and Cleaning Plan, as specified.

F. Material Safety Data Sheets (MSDS): For all chemical products proposed to be used in the cleaning process; submit directly to CPL.

G. Project Closeout Report: Include field quality control reports, evidence of satisfactory cleaning, and documentation of items needing further repair.

1.6 QUALITY ASSURANCE

A. Cleaning Contractor Qualifications: Company specializing in the cleaning and restoration of HVAC systems as specified in this section.

1. Certified by one of the following:

a. NADCA, National Air Duct Cleaners Association: www.nadca.com.

b. Nationally recognized certification program and organization dedicated to the cleaning of HVAC systems.

2. Having minimum of three years documented experience.

3. Employing for this project a supervisor certified by same organization that certified the cleaning contractor.

B. Testing and Inspection Agency Qualifications: Experienced in inspection and testing using methods defined in NADCA ACR.

PART 2 PRODUCTS

2.1 TOOLS AND EQUIPMENT

A. Vacuum Devices and Other Tools: Exceptionally clean, in good working order, and sealed when brought into the facility.

B. Vacuum Devices That Exhaust Air Inside Building, Including Hand-Held and Wet Vacuums: Equipped with HEPA filtration with 99.97 percent collection efficiency for minimum 0.3-micron size particles and DOP test number.

C. Vacuum Devices That Exhaust Air Outside Building, Including Truck- and Trailer-Mounted Types: Equipped with particulate collection including adequate filtration to contain debris removed from the HVAC system; exhausted in manner that prevents contaminant re-entry to building; compliant with applicable regulations as to outdoor environmental contamination.

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PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. NOTE: ONLY DUCTWORK AND AHUs WHICH REMAIN, AFTER THE DEMOLITION PHASE, ARE TO BE CLEANED.

B. Comply with applicable federal, state, and local requirements.

C. Perform cleaning, inspection, and remediation in accordance with the recommendations of NADCA "Assessment, Cleaning and Restoration of HVAC Systems" (ACR) and as specified herein.

D. Where NADCA ACR uses the terms "recommended", "highly recommended", or "ideally" in regard to a certain procedure or activity, do that unless it is clearly inapplicable to the project.

E. Take precautions to prevent introduction of additional hazards into occupied spaces.

F. Comply with requirements of Section 01 57 19.

G. Obtain CPL's approval of proposed temporary locations for large equipment.

H. Designate a decontamination area and obtain CPL's approval.

I. When portions of the facility are to remain occupied or in operation during cleaning activities, provide adequate controls or containment to prevent access to spaces being cleaned by unauthorized persons and provide detailed instructions to CPL as to these controls or containment.

J. If unforeseen mold or other biological contamination is encountered, notify Engineer immediately, identifying areas affected and extent and type of contamination.

3.2 EXAMINATION

A. Prior to the commencement of any cleaning work, prepare and submit to Engineer a project evaluation and plan for this project, including considerations recommended in NADCA ACR.

B. Coordinate cleaning plan with indoor air quality control plan specified in Section 01 57 19.

C. Inspect the system as required to determine appropriate methods, tools, equipment, and protection.

D. Start of cleaning work constitutes acceptance of existing conditions.

E. When concealed spaces are later made accessible, examine and document interior conditions prior to beginning cleaning.

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F. Document all instances of mold growth, rodent droppings, other biological hazards, and damaged system components.

3.3 PREPARATION

A. When cleaning work might adversely affect life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with authorities having jurisdiction.

B. Ensure that electrical components that might be adversely affected by cleaning are de-energized, locked out, and protected prior to beginning work.

C. Air-Volume Control Devices: Mark the original position of dampers and other air-directional mechanical devices inside the HVAC system prior to starting cleaning.

D. Access to Concealed Spaces: Use existing service openings and make additional service openings as required to accomplish cleaning and inspection.

1. Do not cut openings in non-HVAC components without obtaining the prior approval of CPL.
2. Make new openings in HVAC components in accordance with NADCA Standard 05; do not compromise the structural integrity of the system.
3. Do not cut service openings into flexible duct; disconnect at ends for cleaning and inspection.

E. Ceiling Tile: Lay-in ceiling tile may be removed to gain access to HVAC systems during the cleaning process; protect tile from damage and reinstall upon completion; replace damaged tile.

3.4 CLEANING

A. Use any cleaning method recommended by NADCA ACR unless otherwise specified; do not use methods prohibited by NADCA ACR, or that will damage HVAC components or other work, or that will significantly alter the integrity of the system.

B. Obtain CPL's approval before using wet cleaning methods; ensure that drainage is adequate before beginning.

C. Ducts: Mechanically clean all portions of ducts.

D. Hoses, Cables, and Extension Rods: Clean using suitable sanitary damp wipes at the time they are being removed or withdrawn from their normal position.

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E. Registers, Diffusers, and Grilles: When removing, take care to prevent containment exposure due to accumulated debris.

F. Coils: Follow NADCA ACR completely including measuring static pressure drop before and after cleaning; do not remove refrigeration coils from system to clean; report coils that are permanently impacted.

G. Collect debris removed during cleaning; ensure that debris is not dispersed outside the HVAC system during the cleaning process.

H. Store contaminated tools and equipment in polyethylene bags until cleaned in the designated decontamination area.

3.5 REPAIR

A. Repair openings cut in the ventilation system so that they do not significantly alter the airflow or adversely impact the facility's indoor air quality.

B. At insulated ducts and components, accomplish repairs in such a manner as to achieve the equivalent thermal value.

C. Reseal new openings in accordance with NADCA Standard 05.

D. Reseal rigid fiber glass duct systems using closure techniques that comply with UL 181 or UL 181A.

E. When new openings are intended to be capable of being re-opened in the future, clearly mark them and report their locations to CPL in project report documents.

3.6 FIELD QUALITY CONTROL

A. Ensure that the following field quality control activities are completed prior to application of any treatments or coatings and prior to returning HVAC system to normal operation.

B. Employ an independent testing and inspection agency to inspect, test, and prepare documentation.

C. Visually inspect all portions of the cleaned components; if not visibly clean as defined in NADCA ACR, re-clean and reinspect.

D. Coils: Cleaning must restore the coil pressure drop to within 10 percent of the coil's original installed pressure drop; if original pressure drop is not known, coil will be considered clean if free of foreign matter and chemical residue based on visual inspection.

E. Notify Engineer when cleaned components are ready for inspection.

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F. CPL reserves the right to verify cleanliness using NADCA ACR Surface Comparison Testing or NADCA Vacuum Test.

G. Submit evidence that all portions of the system required to be cleaned have been cleaned satisfactorily.

3.7 ADJUSTING

A. After satisfactory completion of field quality control activities, restore adjustable devices to original settings, including, but not limited to, dampers, air directional devices, valves, fuses, and circuit breakers.

3.8 WASTE MANAGEMENT

A. Double-bag waste and debris in 6 mil, 0.006 inch thick polyethylene plastic bags.

B. Dispose of debris off-site in accordance with applicable federal, state and local requirements.

END OF SECTION 23 01 30.51

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SECTION 23 05 17 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe sleeves.

1.2 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 23 05 23 - General-Duty Valves for HVAC Piping.

C. Section 23 05 53 - Identification for HVAC Piping and Equipment: Piping identification.

D. Section 23 07 16 - HVAC Equipment Insulation.

E. Section 23 07 19 - HVAC Piping Insulation.

1.3 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2024.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.

C. FM (AG) - FM Approval Guide; Current Edition.

D. UL (DIR) - Online Certifications Directory; Current Edition.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

1.5 QUALITY ASSURANCE

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

B. Installer Qualifications: Company specializing in performing work of the type specified this section.

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1. Minimum three years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

1.7 WARRANTY

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

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

PART 2 PRODUCTS

2.1 PIPE SLEEVES

A. Manufacturers:

1. American Polywater Corporation; PZVR Watertight Wall Sleeves for Pipes: www.polywater-haufftechnik.com/#sle.
2. Flexicraft Industries; Pipe Wall Sleeve: www.flexicraft.com/#sle.
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Vertical Piping:

1. Sleeve Length: 1 inch above finished floor.
2. Provide sealant for watertight joint.
3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

C. Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

D. Pipe Passing Through Below Grade Exterior Walls:

1. Zinc coated or cast iron pipe.
2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

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E. Pipe Passing Through Mechanical, Laundry, and Animal Room Floors above Basement:

1. Galvanized steel pipe or black iron pipe with asphalt coating.
2. Connect sleeve with floor plate except in mechanical rooms.

F. Clearances:

1. Provide allowance for insulated piping.
2. Wall, Floor, Partitions, and Beam Flanges: 1 inch greater than external pipe diameter.
3. All Rated Openings: Caulked tight with fire stopping material in compliance with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

3.2 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Structural Considerations:

1. Do not penetrate building structural members unless indicated.

E. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.

1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
2. Aboveground Piping:
   a. Pack solid using mineral fiber in compliance with ASTM C592.
   b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.

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3. All Rated Openings: Caulk tight with fire stopping material in compliance with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.
4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

F. Manufactured Sleeve-Seal Systems:

1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a water-tight seal.
6. Install in accordance with manufacturer's recommendations.

G. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.3 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION 23 05 17

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SECTION 23 05 19 - METERS AND GAUGES FOR HVAC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pressure gauges and pressure gauge taps.

B. Thermometers and thermometer wells.

C. Static pressure gauges.

1.2 RELATED REQUIREMENTS

A. Section 23 21 13 - Hydronic Piping.

1.3 REFERENCE STANDARDS

A. ASHRAE Std 135 - BACnet - A Data Communication Protocol for Building Automation and Control Networks; 2024, with Errata (2025).

B. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2022.

C. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014 (Reapproved 2025).

D. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014 (Reapproved 2021).

E. AWWA C700 - Cold-Water Meters -- Displacement Type, Metal Alloy Main Case; 2024.

F. AWWA C701 - Cold-Water Meters -- Turbine Type, for Customer Service; 2024.

G. AWWA C702 - Cold-Water Meters -- Compound Type; 2024.

H. AWWA M6 - Water Meters -- Selection, Installation, Testing, and Maintenance; 2012, with Addendum (2018).

I. Bluetooth CS - Bluetooth Core Specification; 2016, Addendum 2017.

J. FieldComm Group (FFTS) - Foundation Fieldbus Technical Specifications; 2014.

K. IEEE 802.3 - IEEE Standard for Ethernet; 2022 (Corrigendum 2024).

L. IEEE 802.11 - IEEE Standard for Information Technology--Telecommunications and Information Exchange between Systems Local and Metropolitan Area Networks--Specific Requirements

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Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications; 2024, with Amendment (2025).

M. IEEE 802.15.4 - IEEE Standard for Low-Rate Wireless Networks; 2024.

N. LonMark Interoperability Guide - LonMark Application-Layer Interoperability Guide and LonMark Layer 1-6 Interoperability Guide; Version 3.4; 2005.

O. Modbus (PS) - The Modbus Organization Communications Protocol.; Latest Update.

P. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

Q. ODVA (CIP) - The Common Industrial Protocol (CIP) Standards: EtherNet/IP, DeviceNet, ControlNet, and CompoNet; Current Edition.

R. ProfiBus/ProfiNet SSG - ProfiBus, ProfiNet, and IO-Link Specifications, Standards and Guidelines; Current Edition.

S. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

T. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

1.5 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.1 PRESSURE GAUGES

A. Manufacturers:

1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
2. Moeller Instrument Company, Inc: www.moellerinstrument.com/#sle.

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3. Omega Engineering, Inc: www.omega.com/#sle.
4. Winters Instruments: www.winters.com/#sle.

B. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.

1. Case: Steel with brass bourdon tube.
2. Size: 4-1/2 inch diameter.
3. Mid-Scale Accuracy: One percent.
4. Scale: Psi and KPa.

2.2 PRESSURE GAUGE TAPPINGS

A. Gauge Cock: Tee or lever handle, brass for maximum 150 psi.

B. Needle Valve: Brass, 1/4 inch NPT for minimum 150 psi.

C. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections.

D. Syphon: Steel, Schedule 40, 1/4 inch angle or straight pattern.

2.3 STEM TYPE THERMOMETERS

A. Manufacturers:

1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
2. Omega Engineering, Inc: www.omega.com/#sle.
3. Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.
4. Winters Instruments: www.winters.com/#sle.

B. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.

1. Size: 9 inch scale.
2. Window: Clear Lexan.
3. Stem: 3/4 inch NPT brass.
4. Accuracy: 2 percent, per ASTM E77.
5. Calibration: Degrees F.

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2.4 TEST PLUGS

A. Manufacturers:

1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
2. Watts Water Technologies, Inc: www.watts.com/#sle.
3. Weiss Instruments, LLC: www.weissinstruments.com/#sle.
4. Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.
5. Winters Instruments: www.winters.com/#sle.

B. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with Nordel core for temperatures up to 350 degrees F.

2.5 STATIC PRESSURE GAUGES

A. Manufacturers:

1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
2. Omega Engineering, Inc: www.omega.com/#sle.
3. Veris Industries: www.veris.com/#sle.
4. Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.

B. 3-1/2 inch diameter dial in metal case, diaphragm actuated, black figures on white background, front recalibration adjustment, 2 percent of full scale accuracy.

C. Accessories: Static pressure tips with compression fittings for bulkhead mounting, 1/4 inch diameter tubing.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install positive displacement meters with isolating valves on inlet and outlet to AWWA M6. Provide full line size valved bypass with globe valve for liquid service meters.

C. Provide one pressure gauge per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gauge.

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D. Install pressure gauges with pulsation dampers. Provide gauge cock to isolate each gauge. Provide siphon on gauges in steam systems. Extend nipples and siphons to allow clearance from insulation.

E. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

F. Install thermometers in air duct systems on flanges.

G. Install thermometer sockets adjacent to controls system thermostat, transmitter, or sensor sockets. Refer to Section 23 09 43. Where thermometers are provided on local panels, duct or pipe mounted thermometers are not required.

H. Provide instruments with scale ranges selected according to service with largest appropriate scale.

I. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

J. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

K. Locate test plugs adjacent thermometers and thermometer sockets.

END OF SECTION 23 05 19

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SECTION 23 05 23 - GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Globe valves.

B. Ball valves.

C. Check valves.

D. Gate valves.

E. Chainwheels.

1.2 RELATED REQUIREMENTS

A. Section 23 05 48 - Vibration and Seismic Controls for HVAC.

B. Section 23 05 53 - Identification for HVAC Piping and Equipment.

C. Section 23 07 16 - HVAC Equipment Insulation.

D. Section 23 07 19 - HVAC Piping Insulation.

E. Section 23 21 13 - Hydronic Piping.

1.3 ABBREVIATIONS AND ACRONYMS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. PTFE: Polytetrafluoroethylene.

G. RS: Rising stem.

H. TFE: Tetrafluoroethylene.

I. WOG: Water, oil, and gas.

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1.4 REFERENCE STANDARDS

A. API STD 594 - Check Valves: Flanged, Lug, Wafer, and Butt-Welding; 2022.

B. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).

C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.

D. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard; 2025.

E. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves; 2022, with Errata (2023).

F. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

G. ASME B16.34 - Valves — Flanged, Threaded, and Welding End; 2025.

H. ASME B31.1 - Power Piping; 2024.

I. ASME B31.9 - Building Services Piping; 2025.

J. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2025, with Errata.

K. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2022.

L. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2023).

M. ASTM A216/A216M - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service; 2021.

N. ASTM A351/A351M - Standard Specification for Castings, Austenitic, for Pressure-Containing Parts; 2024, with Editorial Revision (2025).

O. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).

P. ASTM A536 - Standard Specification for Ductile Iron Castings; 2024.

Q. ASTM A582/A582M - Standard Specification for Free-Machining Stainless Steel Bars; 2022.

R. ASTM B61 - Standard Specification for Steam or Valve Bronze Castings; 2015 (Reapproved 2021).

S. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017 (Reapproved 2025).

T. AWWA C606 - Grooved and Shouldered Joints; 2022.

U. MSS SP-45 - Drain and Bypass Connections; 2020.

V. MSS SP-67 - Butterfly Valves; 2022.

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W. MSS SP-68 - High Pressure Butterfly Valves with Offset Design; 2021.

X. MSS SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends; 2011.

Y. MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends; 2018.

Z. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service; 2010a.

AA. MSS SP-78 - Gray Iron Plug Valves, Flanged and Threaded Ends; 2011.

BB. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves; 2019.

CC. MSS SP-85 - Gray Iron Globe and Angle Valves, Flanged and Threaded Ends; 2011.

DD. MSS SP-108 - Resilient-Seated Cast Iron Eccentric Plug Valves; 2020.

EE. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

FF. MSS SP-125 - Check Valves: Gray Iron and Ductile Iron, In-Line, Spring-Loaded, Center-Guided; 2018.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in CPL's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

A. Manufacturer:

1. Obtain valves for each valve type from single manufacturer.

2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.

2. Protect valve parts exposed to piped medium against rust and corrosion.

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3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
4. Adjust globe, gate, and angle valves to the closed position to avoid clattering.
5. Secure check valves in either the closed position or open position.

B. Use the following precautions during storage:
1. Maintain valve end protection and protect flanges and specialties from dirt.
a. Provide temporary inlet and outlet caps.
b. Maintain caps in place until installation.
2. Store valves in shipping containers and maintain in place until installation.
a. Store valves indoors in dry environment.
b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

C. Exercise the following precautions for handling:
1. Handle large valves with sling, modified to avoid damage to exposed parts.
2. Avoid the use of operating handles or stems as rigging or lifting points.

PART 2 PRODUCTS

2.1 APPLICATIONS

A. See drawings for specific valve locations.

B. Listed pipe sizes shown using nominal pipe sizes (NPS) and nominal diameter (DN).

C. Provide the following valves for the applications if not indicated on drawings:
1. Throttling (Hydronic): Globe.
2. Isolation (Shutoff): Gate and Ball.
3. Swing Check (Pump Outlet):
a. Size 2 inch and Smaller: Bronze with bronze disc.
b. Size 2-1/2 inch and Larger: Iron with lever and weight, lever and spring, center-guided metal, or center-guided with resilient seat.

D. Substitutions of valves with higher CWP classes or WSP ratings for same valve types are permitted when specified CWP ratings or WSP classes are not available.

E. Required Valve End Connections for Non-Wafer Types:
1. Steel Pipe:

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a. Size 2 inch and Smaller: Threaded ends.

b. Size 2-1/2 inch and Larger: Grooved ends.

2. Copper Tube:

a. Size 2 inch and Smaller: Threaded ends, except solder-joint valve-ends.

b. Size 2-1/2 inch and Larger: Grooved ends.

F. Heating Hot Water Valves:

1. Size 2 inch and Smaller, Brass and Bronze Valves:

a. Threaded ends.

b. Ball: Full port, two piece, stainless steel trim.

c. Globe: Bronze disc, Class 125.

2. Size 2-1/2 inch and Larger, Iron Valves:

a. 2-1/2 inch to 4 inch: Flanged ends.

b. Center-Guided Check: Compact-wafer, metal seat, Class 125.

c. Gate: NRS, Class 125.

2.2 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:

1. Handwheel: Valves other than quarter-turn types.

2. Hand Lever: Quarter-turn valves 6 inch and smaller.

3. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator, of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

D. Valves in Insulated Piping: Provide 2 inch stem extensions and the following features:

1. Gate Valves: Rising stem.

2. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

E. Valve-End Connections:

1. Threaded End Valves: ASME B1.20.1.

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2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
3. Grooved End Connections: AWWA C606.

F. General ASME Compliance:

1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
2. Building Services Piping Valves: ASME B31.9.

G. Bronze Valves:

1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

H. Valve Bypass and Drain Connections: MSS SP-45.

I. Source Limitations: Obtain each valve type from a single manufacturer.

2.3 BRONZE, GLOBE VALVES

A. CWP Rating: Class 125: 200 psi:

1. Comply with MSS SP-80, Type 1.
2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
3. Ends: Threaded or solder joint.
4. Stem and Disc: Bronze or PTFE.
5. Packing: Asbestos free.
6. Handwheel: Malleable iron.

2.4 BRASS, BALL VALVES

A. Two Piece, Full Port with Stainless Steel Trim and Female Thread, Male thread, or Solder Connections:

1. Comply with MSS SP-110.
2. SWP Rating: 150 psi.
3. WOG Rating: 600 psi.
4. Vacuum Rating: 28.9 in-Hg.
5. Body: Forged brass.
6. Seats: PTFE.
7. Stem: Stainless Steel.

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8. Ball: Chrome-plated brass.
9. Hose-End Applications: Provide 3/4-inch hose connection. Include cap, gasket, and chain or tether.
10. Manufacturers:
    a. Apollo Valves; _____: www.apollovalves.com/#sle.
    b. Bonomi North America, Inc: www.bonominorthamerica.com/#sle.
    c. Effebi; Gladiator: www.effebi.com/#sle
    d. FNW; 410A: www.fnw.com/#sle.
    e. Kitz Corporation of America; #68: www.kitzus-kca.com/#sle.
    f. Mueller Streamline, Co; Series 7700: www.muellerstreamline.com/#sle.

2.5 BRONZE, BALL VALVES

A. General:
1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

B. Two Piece, Full Port with Bronze or Brass Trim:
1. Comply with MSS SP-110.
2. WSP Rating: 150 psi.
3. WOG Rating: 400 psi.
4. Body: Forged bronze or dezincified-brass alloy.
5. End Connections: Pipe thread or solder.
6. Seats: PTFE.
7. Stem: Stainless steel.
8. Ball: Chrome plated brass.
9. Operator: Provide stem extension.
10. Manufacturers:
    a. Apollo Valves; _____: www.apollovalves.com/#sle.
    b. Bonomi North America, Inc: www.bonominorthamerica.com/#sle.
    c. FNW; X450: www.fnw.com/#sle.
    d. NIBCO INC: www.nibco.com/#sle.

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2.6 BRASS, INLINE CHECK VALVES

A. Class 150: CWP Rating: 200 psi .

B. Maximum Service Temperature: 250 degreess F.

C. Body: Forged brass.

D. Disc: Forged brass.

E. Seal: PTFE, bubble tight.

F. End-Connections: Press.

2.7 BRONZE, SWING CHECK VALVES

A. Class 125:

1. Pressure and Temperature Rating: MSS SP-80, Type 3.
2. Design: Y-pattern, horizontal or vertical flow.
3. WSP Rating: 200 psi.
4. Body: Bronze, ASTM B62.
5. End Connections: Threaded or soldered.
6. Disc: Bronze.

2.8 IRON, SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125:

1. Comply with MSS SP-71, Type I.
2. Sizes 2-1/2 to 12 inch: CWP Rating; 200 psi.
3. Body Design: Clear or full waterway.
4. Body Material: ASTM A126, gray iron with bolted bonnet.
5. Ends: Flanged.
6. Trim: Bronze.
7. Gasket: Asbestos free.
8. Closer Control: Factory installed, exterior lever, and spring or weight.

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2.9 IRON, CENTER-GUIDED CHECK VALVES

A. Class 125, Compact-Wafer:

1. Comply with MSS SP-125.
2. Sizes 2-1/2 to 12 inch: CWP Rating; 200 psi.
3. Body Material: ASTM A126, gray iron.
4. Metal Seat: Bronze.
5. Manufacturers:
    a. Apollo Valves: www.apollovalves.com/#sle.
    b. NIBCO INC: www.nibco.com/#sle.
    c. Substitutions: See Section 01 60 00 - Product Requirements.

2.10 IRON, GATE VALVES

A. NRS or OS&Y:

1. Comply with MSS SP-70, Type I.
2. Class 125:
    a. Sizes 2-1/2 to 12 inch, CWP Rating; 200 psi.
    b. Sizes 14 to 24 inch, CWP Rating; 500 psi.
3. Body Material: Gray iron with bolted bonnet.
4. Ends: Flanged.
5. Trim: Bronze.
6. Disc: Solid wedge.
7. Packing and Gasket: Asbestos free.
8. Manufacturers:
    a. Apollo Valves: www.apollovalves.com/#sle.
    b. FNW; 651B: www.fnw.com/#sle.
    c. NIBCO INC: www.nibco.com/#sle.

2.11 CHAINWHEELS

A. Description: Valve actuation assembly with sprocket rim, brackets, and chain.

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1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
2. Attachment: For connection to ball, butterfly, and plug valve stems.
3. Sprocket Rim with Chain Guides: Ductile iron include zinc coating.
4. Chain: Hot-dip galvanized steel. Sized to fit sprocket rim.

PART 3 EXECUTION

3.1 EXAMINATION

A. Discard all packing materials and verify that valve interior, including threads and flanges, are completely clean without signs of damage or degradation that could result in leakage.

B. Verify valve parts to be fully operational in all positions from closed to fully open.

C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.

D. Should valve is determined to be defective, replace with new valve.

3.2 INSTALLATION

A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.

B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

C. Where valve support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welds.

D. Install check valves where necessary to maintain direction of flow as follows:

1. Lift Check: Install with stem plumb and vertical.
2. Swing Check: Install horizontal maintaining hinge pin level.
3. Orient plate-type and center-guided into horizontal or vertical position, between flanges.

E. Provide chainwheels on operators for valves 4 NPS and larger where located 96 inches or more above finished floor, terminating 60 inches above finished floor.

END OF SECTION 23 05 23

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SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment components.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 05 50 00 - Metal Fabrications: Materials and requirements for fabricated metal supports.

C. Section 23 05 48 - Vibration and Seismic Controls for HVAC.

1.3 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2025.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2024.

G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).

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

I. 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; 2025.

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J. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

K. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.

L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

M. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

N. FM (AG) - FM Approval Guide; Current Edition.

O. MFMA-4 - Metal Framing Standards Publication; 2004.

P. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2025.

Q. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

R. UL (DIR) - Online Certifications Directory; Current Edition.

S. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.

2. Coordinate the work with other trades to provide additional framing and materials required for installation.

3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.

4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.

5. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

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1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.

1.6 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Installer Qualifications for Field-Welding: As specified in Section 05 50 00.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.

2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.

3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 3. Include consideration for vibration, equipment operation, and shock loads where applicable.

4. Do not use chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.

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5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
    a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
    b. Outdoor and Damp or Wet Indoor Locations: Use stainless steel unless otherwise indicated.
    c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
    d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Strut Channels:
1. Manufacturers:
    a. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
    b. Gripple, Inc; Universal Bracket: www.gripple.com/#sle.
    c. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
    d. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.
2. ASTM A653/A653M galvanized steel bracket with clamps for surface mounting of piping or plumbing equipment support.
3. Channel or Bracket Kits: Include rods, brackets, end-fixed fittings, covers, clips, and other related hardware required to complete sectional trapeze section for piping or other support.

C. Channel Nuts:
1. Provide carbon steel channel nut with epoxy copper or zinc finish and long, regular, or short spring.

D. Hanger Rods:
1. Threaded zinc-plated steel unless otherwise indicated.
2. Minimum Size, Unless Otherwise Indicated or Required:
    a. Equipment Supports: 1/2 inch diameter.
    b. Piping up to 1 inch: 1/4 inch diameter.
    c. Piping larger than 1 inch: 3/8 inch diameter.
    d. Trapeze Support for Multiple Pipes: 3/8 inch diameter.

E. Cable Hanging System Kits:

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1. Manufacturers:
    a. B-Line, a brand of Eaton Corporation; _____: www.eaton.com/#sle.
    b. Ductmate Industries, Inc; _____: ductmate.com/#sle.
    c. Gripple, Inc; _____: www.gripple.com/#sle.
    d. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.
2. Provide cable-wire in bulk or precut lengths with respective cable hangers as required to hold minimum weight of 120 lb.
3. Accessories: Provide brackets, clip or c-clip hangers, covers, and y-hook hangers.

F. Thermal Insulated Pipe Supports:
1. General Requirements:
    a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
    b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
    c. Pipe supports to be provided for nominally sized, 1/2 to 30 inch iron pipes.
    d. Insulation inserts to consist of rigid polyisocyanurate (urethane) insulation surrounded by a 360 degree, PVC jacketing.
2. PVC Jacket:
    a. Pipe insulation protection shields to be provided with a ball bearing hinge and locking seam.
    b. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
    c. Thickness: 60 mil.
3. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings.

G. Pipe Supports:
1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
2. Liquid Temperatures Up To 122 degrees F:
    a. Overhead Support: MSS SP-58 Types 1, 3 through 12.
    b. Support From Below: MSS SP-58 Types 35 through 38.

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3. Operating Temperatures from 122 to 446 degrees F:
    a. Overhead Support: MSS SP-58 Type 1 or 3 through 12, with appropriate saddle of MSS SP-58 Type 40 for insulated pipe.
    b. Roller Support: MSS SP-58 Types 41 or 43 through 46, with appropriate saddle of MSS SP-58 Type 39 for insulated pipe.

H. Roller Chairs:
1. MSS SP-58 type 43 based on required load, nonconductive and corrosion resistant.
2. Steel Yoke Type: MSS SP-58 type 44, vertically adjustable, nonconductive, and corrosion resistant.
3. Material: Zinc plated ASTM A36/A36M carbon steel or ASTM A47/A47M malleable iron.

I. Beam Clamps:
1. MSS SP-58 types 19 through 23, 25 or 27 through 30 based on required load.
2. Beam C-Clamp: MSS SP-58 type 23, malleable iron and steel with plain, stainless steel, and zinc finish.
3. Small or Junior Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish. For inverted usage provide manufacturer listed size(s).
4. Wide Mouth Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish.
5. Centerload Beam Clamp with Extension Piece: MSS SP-58 type 30, malleable iron with plain finish.
6. FM (AG) and UL (DIR) Approved Beam Clamp: MSS SP-58 type 19, plain finish,
7. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
8. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.

J. Riser Clamps:
1. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
2. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, plain, stainless steel, or zinc plated finish.
3. Medium Split Horizontal Pipe Clamp: MSS SP-58 type 4, carbon steel or stainless steel with epoxy plated, plain, stainless steel, or zinc plated finish.
4. Copper Tube Pipe Clamp: MSS SP-58 type 8, epoxy plated copper.
5. UL (DIR) listed: Pipe sizes 1/2 to 8 inch.

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K. U-Bolts:

1. MSS SP-58 Type 24, carbon steel u-bolt for pipe support or anchoring.

L. Strut Clamps:

1. Pipe Clamp: Two-piece rigid, universal, or outer diameter type, carbon steel with epoxy copper or zinc finish.
2. Cushioned Pipe or Tubing Strut Clamp: Provide strut clamp with thermoplastic elastomer cushion having dielectric strength of 670 V/mil.
3. Service Temperature Range: Minus 65 to 275 degrees F.

M. Pipe Hangers:

1. Band Hangers, Adjustable:
   a. MSS SP-58 Type 7 or 9, Zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
2. Clevis Hangers, Adjustable:
   a. Copper Tube: MSS SP-58 Type 1, epoxy-plated copper.
   b. Felt-Lined: MSS SP-58 Type 1, zinc-plated, silicone-free carbon steel.
   c. Standard-Duty: MSS SP-58 Type 1, zinc-colored, epoxy plated.
   d. UL (DIR) listed: Pipe sizes 2-1/2 to 8 inch.
   e. FM (AG) listed: Pipe sizes 2-1/2 to 8 inch.

N. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.

O. Pipe Shields for Insulated Piping:

1. Manufacturers:
   a. Anvil International: www.anvilintl.com/#sle.
   b. FNW; 7750: www.fnw.com/#sle.
   c. Substitutions: See Section 01 60 00 - Product Requirements.
   d. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.
2. General Construction and Requirements:
   a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
   b. Shields Material: UV-resistant polypropylene with glass fill.
   c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.

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d. Minimum Service Temperature: Minus 40 degrees F.

e. Maximum Service Temperature: 178 degrees F.

f. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

P. Anchors and Fasteners:

1. Manufacturers - Mechanical Anchors:

a. FNW; 7502: www.fnw.com/#sle.

b. Hilti, Inc: www.us.hilti.com/#sle.

c. Simpson Strong-Tie Company Inc; _____: www.strongtie.com/#sle.

2. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

3. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.

4. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.

5. Hollow Masonry: Use toggle bolts.

6. Hollow Stud Walls: Use toggle bolts.

7. Steel: Use beam-ceiling clamps, beam clamps, machine bolts, or welded threaded studs.

8. Beam Ceiling Flanges: ASTM A47/A47M Grade 32510, malleable iron or stainless steel with copper, plain, stainless steel, or zinc finish.

9. Sheet Metal: Use sheet metal screws.

10. Wood: Use wood screws.

11. Plastic and lead anchors are not permitted.

12. Powder-actuated fasteners are not permitted.

13. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.

a. Comply with MFMA-4.

b. Channel Material: Use galvanized steel.

c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

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PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

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

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

D. Unless specifically indicated or approved by Engineer, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Engineer, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

H. Equipment Support and Attachment:

1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.

2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.

3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.

4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3 inch high concrete pad constructed in accordance with Section 03 30 00.

5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

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I. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.

J. Secure fasteners according to manufacturer's recommended torque settings.

K. Remove temporary supports.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 23 05 29

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SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

1.2 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting: Identification painting.

1.3 REFERENCE STANDARDS

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

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2025.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates.

B. Air Terminal Units: Tags.

C. Automatic Controls: Tags. Key to control schematic.

D. Control Panels: Nameplates.

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E. Heat Transfer Equipment: Nameplates.

F. Pumps: Nameplates.

G. Valves: Tags.

2.2 NAMEPLATES

A. Manufacturers:

1. Advanced Graphic Engraving, LLC: www.advancedgraphicengraving.com/#sle.
2. Brimar Industries, Inc: www.pipemarker.com/#sle.
3. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
5. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.

B. Letter Color: White.

C. Letter Height: 1/4 inch.

D. Background Color: Black.

E. Plastic: Comply with ASTM D709.

2.3 TAGS

A. Manufacturers:

1. Advanced Graphic Engraving: www.advancedgraphicengraving.com/#sle.
2. Brady Corporation: www.bradycorp.com/#sle.
3. Brimar Industries, Inc: www.pipemarker.com/#sle.
4. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
5. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
6. Seton Identification Products, a Tricor Company: www.seton.com/#sle.

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

D. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

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2.4 PIPE MARKERS

A. Manufacturers:

1. Brady Corporation: www.bradycorp.com/#sle.
2. Brimar Industries, Inc: www.pipemarker.com/#sle.
3. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
5. Seton Identification Products, a Tricor Company: www.seton.com/#sle.

B. Color: Comply with ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Underground Plastic Pipe Markers: Bright-colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil, 0.004 inch thick, manufactured for direct burial service.

E. Color code as follows:

1. Heating, Cooling, and Boiler Feedwater: Green with white letters.
2. Toxic and Corrosive Fluids: Orange with black letters.
3. Compressed Air: Blue with white letters.

PART 3 EXECUTION

3.1 PREPARATION

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

B. Prepare surfaces in accordance with Section 09 91 23 for stencil painting.

3.2 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

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D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

F. Use tags on piping 3/4 inch diameter and smaller.

1. Identify service, flow direction, and pressure.

2. Install in clear view and align with axis of piping.

3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

G. Install ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

H. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 23 05 53

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SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic, steam, and refrigerating systems.

C. Measurement of final operating condition of HVAC systems.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.

B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2024, with Errata (2025).

C. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2023.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.

1. Submit to Engineer.
2. Submit six weeks prior to starting the testing, adjusting, and balancing work.
3. Include certification that the plan developer has reviewed Contract Documents, the equipment and systems, and the control system with the Engineer and other installers to sufficiently understand the design intent for each system.
4. Include at least the following in the plan:
    a. Preface: An explanation of the intended use of the control system.

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b. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.

c. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.

d. Identification and types of measurement instruments to be used and their most recent calibration date.

e. Discussion of what notations and markings will be made on the duct and piping drawings during the process.

f. Final test report forms to be used.

g. Detailed step-by-step procedures for TAB work for each system and issue, including:

    1) Terminal flow calibration (for each terminal type).

    2) Diffuser proportioning.

    3) Branch/submain proportioning.

    4) Total flow calculations.

    5) Rechecking.

    6) Diversity issues.

h. Expected problems and solutions, etc.

i. Details of how TOTAL flow will be determined; for example:

    1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.

    2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.

j. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.

k. Confirmation of understanding of the outside air ventilation criteria under all conditions.

l. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).

m. Method of checking building static and exhaust fan and/or relief damper capacity.

n. Methods for making coil or other system plant capacity measurements, if specified.

o. Time schedule for TAB work to be done in phases (by floor, etc.).

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p. Description of TAB work for areas to be built out later, if any.

q. Time schedule for deferred or seasonal TAB work, if specified.

r. False loading of systems to complete TAB work, if specified.

s. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.

t. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).

u. Procedures for formal progress reports, including scope and frequency.

v. Procedures for formal deficiency reports, including scope, frequency and distribution.

D. Field Logs: Submit at least twice a week to the Commissioning Provider.

E. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

F. Progress Reports.

G. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

1. Revise TAB plan to reflect actual procedures and submit as part of final report.

2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Engineer and for inclusion in operating and maintenance manuals.

3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.

4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.

5. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.

6. Include the following on the title page of each report:

a. Name of Testing, Adjusting, and Balancing Agency.

b. Address of Testing, Adjusting, and Balancing Agency.

c. Telephone number of Testing, Adjusting, and Balancing Agency.

d. Project name.

e. Project location.

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f. Project Engineer.

g. Project Contractor.

h. Project altitude.

i. Report date.

H. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. **NOTE THAT ALL EXISTING AHUS AND THE NEW ROOF TOP UNIT, AND ADDITIONAL ITEMS IDENTIFIED BELOW, SHALL BE TESTED, ADJUSTED AND BALANCED.**

B. Perform total system balance in accordance with one of the following:

1. AABC (NSTSB), AABC National Standards for Total System Balance.
2. SMACNA (TAB).
3. Maintain at least one copy of the standard to be used at project site at all times.

C. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

D. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

E. TAB Agency Qualifications:

1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
2. Having minimum of three years documented experience.
3. Certified by one of the following:

a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.

b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.

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c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.

F. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.2 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:

1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place.
15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.3 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.

1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

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B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Engineer to facilitate spot checks during testing.

C. Provide additional balancing devices as required.

3.4 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.5 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:

1. Running log of events and issues.
2. Discrepancies, deficient or uncompleted work by others.
3. Contract interpretation requests.
4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the CPL.

H. Check and adjust systems approximately six months after final acceptance and submit report.

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3.6 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

M. Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.

N. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

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3.7 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.8 SCOPE

A. Test, adjust, and balance the following:

1. Electric Water Coolers.
2. Plumbing Pumps.
3. HVAC Pumps.
4. Boilers.
5. Air Cooled Refrigerant Condensers.
6. Packaged Roof Top Heating/Cooling Units.
7. Computer Room Air Conditioning Units.
8. Terminal Heat Transfer Units.
9. ExAir Handling Units.
10. Fans.
11. Air Filters.
12. Air Terminal Units.
13. Air Inlets and Outlets.

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3.9 MINIMUM DATA TO BE REPORTED

A. Electric Motors:

1. Manufacturer.
2. Model/Frame.
3. HP/BHP.
4. Phase, voltage, amperage; nameplate, actual, no load.
5. RPM.
6. Service factor.
7. Starter size, rating, heater elements.
8. Sheave Make/Size/Bore.

B. V-Belt Drives:

1. Identification/location.
2. Required driven RPM.
3. Driven sheave, diameter and RPM.
4. Belt, size and quantity.
5. Motor sheave diameter and RPM.
6. Center to center distance, maximum, minimum, and actual.

C. Pumps:

1. Identification/number.
2. Manufacturer.
3. Size/model.
4. Impeller.
5. Service.
6. Design flow rate, pressure drop, BHP.
7. Actual flow rate, pressure drop, BHP.
8. Discharge pressure.
9. Suction pressure.
10. Total operating head pressure.
11. Shut off, discharge and suction pressures.
12. Shut off, total head pressure.

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D. Combustion Equipment:
    1. Boiler manufacturer.
    2. Model number.
    3. Serial number.
    4. Firing rate.
    5. Overfire draft.
    6. Gas meter timing dial size.
    7. Gas meter time per revolution.
    8. Gas pressure at meter outlet.
    9. Gas flow rate.
    10. Heat input.
    11. Burner manifold gas pressure.
    12. Percent carbon monoxide (CO).
    13. Percent carbon dioxide (CO2).
    14. Percent oxygen (O2).
    15. Percent excess air.
    16. Flue gas temperature at outlet.
    17. Ambient temperature.
    18. Net stack temperature.
    19. Percent stack loss.
    20. Percent combustion efficiency.
    21. Heat output.
E. Air Cooled Condensers:
    1. Identification/number.
    2. Location.
    3. Manufacturer.
    4. Model number.
    5. Serial number.
    6. Entering DB air temperature, design and actual.
    7. Leaving DB air temperature, design and actual.

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8. Number of compressors.

F. Cooling Coils:

1. Identification/number.
2. Location.
3. Service.
4. Air flow, design and actual.
5. Entering air DB temperature, design and actual.
6. Entering air WB temperature, design and actual.
7. Leaving air DB temperature, design and actual.
8. Leaving air WB temperature, design and actual.
9. Water flow, design and actual.
10. Water pressure drop, design and actual.
11. Entering water temperature, design and actual.
12. Leaving water temperature, design and actual.
13. Saturated suction temperature, design and actual.
14. Air pressure drop, design and actual.

G. Heating Coils:

1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Water flow, design and actual.
7. Water pressure drop, design and actual.
8. Entering water temperature, design and actual.
9. Leaving water temperature, design and actual.
10. Entering air temperature, design and actual.
11. Leaving air temperature, design and actual.
12. Air pressure drop, design and actual.

H. Air Moving Equipment:

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1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Arrangement/Class/Discharge.
6. Air flow, specified and actual.
7. Return air flow, specified and actual.
8. Outside air flow, specified and actual.
9. Total static pressure (total external), specified and actual.
10. Inlet pressure.
11. Discharge pressure.
12. Sheave Make/Size/Bore.
13. Number of Belts/Make/Size.
14. Fan RPM.

I. Return Air/Outside Air:

1. Identification/location.
2. Design air flow.
3. Actual air flow.
4. Design return air flow.
5. Actual return air flow.
6. Design outside air flow.
7. Actual outside air flow.
8. Return air temperature.
9. Outside air temperature.
10. Required mixed air temperature.
11. Actual mixed air temperature.
12. Design outside/return air ratio.
13. Actual outside/return air ratio.

J. Exhaust Fans:

1. Location.

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2. Manufacturer.
3. Model number.
4. Serial number.
5. Air flow, specified and actual.
6. Total static pressure (total external), specified and actual.
7. Inlet pressure.
8. Discharge pressure.
9. Sheave Make/Size/Bore.
10. Number of Belts/Make/Size.
11. Fan RPM.

K. Duct Traverses:

1. System zone/branch.
2. Duct size.
3. Area.
4. Design velocity.
5. Design air flow.
6. Test velocity.
7. Test air flow.
8. Duct static pressure.
9. Air temperature.
10. Air correction factor.

L. Duct Leak Tests:

1. Description of ductwork under test.
2. Duct design operating pressure.
3. Duct design test static pressure.
4. Duct capacity, air flow.
5. Maximum allowable leakage duct capacity times leak factor.
6. Test apparatus:
    a. Blower.
    b. Orifice, tube size.

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c. Orifice size.

d. Calibrated.

7. Test static pressure.

8. Test orifice differential pressure.

9. Leakage.

M. Air Monitoring Stations:

1. Identification/location.

2. System.

3. Size.

4. Area.

5. Design velocity.

6. Design air flow.

7. Test velocity.

8. Test air flow.

N. Flow Measuring Stations:

1. Identification/number.

2. Location.

3. Size.

4. Manufacturer.

5. Model number.

6. Serial number.

7. Design Flow rate.

8. Design pressure drop.

9. Actual/final pressure drop.

10. Actual/final flow rate.

11. Station calibrated setting.

O. Terminal Unit Data:

1. Manufacturer.

2. Type, constant, variable, single, dual duct.

3. Identification/number.

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4. Location.
5. Model number.
6. Size.
7. Minimum static pressure.
8. Minimum design air flow.
9. Maximum design air flow.
10. Maximum actual air flow.
11. Inlet static pressure.

P. Air Distribution Tests:

1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Area factor.
6. Design velocity.
7. Design air flow.
8. Test (final) velocity.
9. Test (final) air flow.
10. Percent of design air flow.

END OF SECTION 23 05 93

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SECTION 23 07 13 - DUCT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Duct insulation.

B. Duct liner.

1.2 RELATED REQUIREMENTS

A. Section 23 05 53 - Identification for HVAC Piping and Equipment.

B. Section 23 31 00 - HVAC Ducts and Casings: Glass fiber ducts.

1.3 REFERENCE STANDARDS

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

B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

C. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2024).

D. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

E. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2017 (Reapproved 2023).

F. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2025.

G. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2024.

H. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

I. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).

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J. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2020.

K. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2025.

L. ASTM C1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation; 2024.

M. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation; 2023.

N. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts; 2016 (Reapproved 2021).

O. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2025.

P. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers; 2015 (Reapproved 2022).

Q. ASTM C1410 - Standard Specification for Cellular Melamine Thermal and Sound-Absorbing Insulation; 2017 (Reapproved 2023).

R. ASTM C1423 - Standard Guide for Selecting Jacketing Materials for Thermal Insulation; 2021.

S. ASTM C1775 - Standard Specification for Laminate Protective Jacket and Tape for Use Over Thermal Insulation for Outdoor Applications; 2022.

T. ASTM D5590 - Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay; 2017 (Reapproved 2021).

U. ASTM D93 - Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester; 2025.

V. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

W. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

X. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

Y. FM 4924 - Examination Standard for Pipe and Duct Insulation; 2024.

Z. SAE AMS3779 - Tape, Adhesive, Pressure-Sensitive Thermal Radiation Resistant, Aluminum Coated Glass Cloth; 2016b.

AA. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

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BB. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

CC. UL 181A - Closure Systems for Use with Rigid Air Ducts; Current Edition, Including All Revisions.

DD. UL 181B - Closure Systems for Use with Flexible Air Ducts and Air Connectors; Current Edition, Including All Revisions.

EE. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.5 QUALITY ASSURANCE

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

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum 3 years of experience and approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.7 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

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PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER, FLEXIBLE

A. Manufacturer:

1. CertainTeed Corporation: www.certainteed.com/#sle.
2. Johns Manville: www.jm.com/#sle.
3. Knauf Insulation; Performance+ Duct Wrap: www.knaufinsulation.com/#sle.
4. Manson Insulation, a company of Knauf Insulation; AK FLEX with ECOSE (High-Temperature Application and Diameters Exceeding 10"): www.imanson.com/#sle.
5. Owens Corning Corporation; SOFTR Duct Wrap FRK: www.owenscorning.com/en-us/#sle.

B. Insulation: ASTM C553; flexible, noncombustible blanket.

1. K value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
2. Maximum Service Temperature: 250 degrees F.
3. Maximum Water Vapor Absorption: 5.0 percent by weight.

C. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with pressure-sensitive tape.

D. Vapor Barrier Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

E. Indoor Vapor Barrier Mastic:

1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

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2.3 GLASS FIBER, RIGID

A. Manufacturer:

1. CertainTeed Corporation: www.certainteed.com/#sle.
2. Johns Manville: www.jm.com/#sle.
3. Knauf Insulation; Earthwool Insulation Board: www.knaufinsulation.com/#sle.
4. Manson Insulation, a company of Knauf Insulation; AK Board: www.imanson.com/#sle.
5. Owens Corning Corporation; 700 Series FIBERGLAS Insulation: www.owenscorning.com/en-us/#sle.

B. Insulation: ASTM C612; rigid, noncombustible.

1. K Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
2. Maximum Service Temperature: 450 degrees F.
3. Maximum Water Vapor Absorption: 5.0 percent.
4. Maximum Density: 8.0 pcf.

C. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with pressure-sensitive tape.

D. Vapor Barrier Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

E. Indoor Vapor Barrier Finish:

1. Cloth: Untreated; 9 oz/sq yd weight, glass fabric.
2. Vinyl emulsion type acrylic, compatible with insulation, black color.

2.4 DUCT LINER

A. Manufacturers:

1. Aeroflex USA; AEROFLEX Breathe-EZ: www.aeroflexusa.com/#sle.
2. Armacell LLC; ArmaFlex Ultima: www.armacell.us/#sle.
3. Ductmate Industries, Inc, a DMI Company; _____: www.ductmate.com/#sle.

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4. Johns Manville; _____: www.jm.com/#sle.
5. Owens Corning Corporation; QuietR Rotary Duct Insulation: www.owenscorning.com/en-us/#sle.

B. Elastomeric Foam Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
1. Minimum Service Temperature: Minus 40 degrees F.
2. Maximum Service Temperature: 180 degrees F.
3. Fungal Resistance: No growth when tested according to ASTM G21.
4. Apparent Thermal Conductivity: Maximum of 0.28 at 75 degrees F.
5. Minimum Noise Reduction Coefficients:
6. Erosion Resistance: Does not show evidence of breaking away, flaking off, or delamination at velocities of 10,000 fpm when tested in accordance with ASTM C1071.
7. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation. Comply with ASTM C916.

D. Liner Fasteners: Galvanized steel, self-adhesive pad or impact applied with integral head.

PART 3 EXECUTION

3.1 EXAMINATION

A. Test ductwork for design pressure prior to applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated Ducts Conveying Air Below Ambient Temperature:
1. Provide insulation with vapor barrier jackets.
2. Finish with tape and vapor barrier jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

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4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Insulated Ducts Conveying Air Above Ambient Temperature:

1. Provide with or without standard vapor barrier jacket.
2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

E. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor): Finish with aluminum jacket.

F. Duct and Plenum Liner Application:

1. Adhere insulation with adhesive for 100 percent coverage.
2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
3. Seal and smooth joints. Seal and coat transverse joints.
4. Seal liner surface penetrations with adhesive.
5. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.

3.3 SCHEDULES

A. Exhaust Ducts Within 30 ft of Exterior Openings: 2" Fiberglass board insulation

B. Outside Air Intake Ducts: 2" Fiberglass board insulation

C. Supply Ducts: 2" fiberglass jacket insulation

D. Supply, Return and Relief Ducts in Mechanical Rooms: 2" Board insulation

END OF SECTION 23 07 13

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SECTION 23 07 19 - HVAC PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

B. Jacketing and accessories.

1.2 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 23 21 13 - Hydronic Piping: Placement of hangers and hanger inserts.

C. Section 23 23 00 - Refrigerant Piping: Placement of inserts.

1.3 REFERENCE STANDARDS

A. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

B. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2026.

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

D. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

E. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2024).

F. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2024).

G. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

H. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2017 (Reapproved 2023).

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I. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2025.

J. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.

K. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2022.

L. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2024.

M. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.

N. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing; 2022.

O. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation; 2022.

P. ASTM C610 - Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation; 2017 (Reapproved 2023).

Q. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).

R. ASTM C1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation; 2024.

S. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation; 2023.

T. ASTM C1410 - Standard Specification for Cellular Melamine Thermal and Sound-Absorbing Insulation; 2017 (Reapproved 2023).

U. ASTM C1423 - Standard Guide for Selecting Jacketing Materials for Thermal Insulation; 2021.

V. ASTM C1775 - Standard Specification for Laminate Protective Jacket and Tape for Use Over Thermal Insulation for Outdoor Applications; 2022.

W. ASTM D93 - Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester; 2025.

X. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).

Y. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 2022.

Z. ASTM D610 - Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces; 2025.

AA. ASTM D1056 - Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber; 2020.

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BB. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics; 2016 (Reapproved 2023).

CC. ASTM D1623 - Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics; 2017 (Reapproved 2023).

DD. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2025.

EE. ASTM D5590 - Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay; 2017 (Reapproved 2021).

FF. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

GG. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

HH. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

II. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

JJ. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

KK. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

LL. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013 (Reapproved 2021).

MM. FM 4924 - Examination Standard for Pipe and Duct Insulation; 2024.

NN. SAE AMS3779 - Tape, Adhesive, Pressure-Sensitive Thermal Radiation Resistant, Aluminum Coated Glass Cloth; 2016b.

OO. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

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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.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum 3 years of experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.7 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER, RIGID

A. Manufacturers:

1. CertainTeed Corporation: www.certainteed.com/#sle.
2. Johns Manville Corporation: www.jm.com/#sle.
3. Knauf Insulation; Performance+ Earthwool 1000 Pipe Insulation: www.knaufinsulation.com/#sle.
4. Manson Insulation, a company of Knauf Insulation; Alley-K Pipe Insulation: www.imanson.com/#sle.
5. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: www.owenscorning.com/en-us/#sle.

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6. Owens Corning Corporation; VaporWick Pipe Insulation: www.owenscorning.com/en-us/#sle.

B. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

C. Vapor Barrier Lap Adhesive: Compatible with insulation.

D. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

E. Fibrous Glass Fabric:

1. Cloth: Untreated; 9 oz/sq yd weight.

2. Blanket: 1.0 pcf density.

3. Weave: 5 by 5.

2.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:

1. Aeroflex USA; AEROFLEX Self-Seal: www.aeroflexusa.com/#sle.

2. Armacell LLC; AP ArmaFlex: www.armacell.us/#sle.

3. K-Flex USA LLC; Insul-Tube: www.kflexusa.com/#sle.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.

1. Minimum Service Temperature: Minus 40 degrees F.

2. Maximum Service Temperature: 180 degrees F.

3. Connection: Waterproof vapor barrier adhesive.

4. Flammability Rating: FM 4924 approval for reduced combustibility testing.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

D. Weather Barrier Coating: Air dried, contact adhesive, compatible with insulation and ASTM E84 compliant.

2.4 JACKETING AND ACCESSORIES

A. Aluminum Jacket:

1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.

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2. Thickness: 0.016 inch sheet.
3. Type: Factory-applied, self-adhesive jacketing.
4. Finish: Embossed.
5. Joining: Longitudinal slip joints and 2 inch laps.
6. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.
7. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.1 EXAMINATION

A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated Pipes Conveying Fluids Below Ambient Temperature:

1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass Fiber Insulated Pipes Conveying Fluids Below Ambient Temperature:

1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

G. Glass Fiber Insulated Pipes Conveying Fluids Above Ambient Temperature:

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1. Provide standard jackets, with or without vapor barrier, factory-applied, or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

H. Inserts and Shields:

1. Application: Piping 1-1/2 inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert location: Between support shield and piping and under the finish jacket.
4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 07 84 00.

J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with aluminum jacket.

K. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV-resistant finish for flexible elastomeric cellular insulation without jacketing.

L. Buried Piping: Provide factory-fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with 1 mil, 0.001 inch thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with polyester film.

3.3 SCHEDULE

A. Heating Systems:

1. Heating Water Supply and Return: 2" rigid molded fiberglass

B. Cooling Systems:

1. Refrigerant Suction: 2" closed cell insulation with aluminum jacket

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2. Refrigerant Hot Gas: 2" closed cell insulation with aluminum jacket

END OF SECTION 23 07 19

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SECTION 23 09 13 - INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Control panels.

B. Control Valves:

1. Globe valves with factory-mounted actuators.

2. Electronic valve operators.

C. Dampers.

D. Damper Operators:

1. Electric operators.

E. Humidistats:

1. Room humidistats.

F. Wall-, Surface-, and Duct-Mounted Sensors:

1. Temperature sensors.

2. Humidity sensors.

3. Building static pressure transmitters.

4. Static air pressure sensors.

5. Air pressure transmitters.

6. Airflow meters; thermal dispersion.

7. Damper position indicators.

8. R-454B refrigerant sensors.

G. Thermostats:

1. Electric thermostats.

2. Freezestats.

H. Fan and pump motor run-status monitoring.

I. Pipe-Mounted Sensors and Transmitters:

1. Temperature sensors.

2. Pressure transmitters.

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3. Differential pressure transmitters.

1.2 RELATED REQUIREMENTS

A. Section 23 05 19 - Meters and Gauges for HVAC Piping: Thermometer sockets and gauge taps.

B. Section 23 21 13 - Hydronic Piping: Installation of control valves, flow switches, temperature sensor sockets, and gauge taps.

C. Section 23 21 14 - Hydronic Specialties.

D. Section 23 33 00 - Air Duct Accessories.

E. Section 25 35 13 - Integrated Automation Actuators and Operators.

F. Section 25 36 19 - Integrated Automation Current Sensors.

G. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

H. Section 26 27 26 - Wiring Devices: Elevation of exposed components.

1.3 REFERENCE STANDARDS

A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2018.

B. ANSI C12.1 - Electric Meters - Code for Electricity Metering; 2024.

C. ANSI C12.10 - American National Standard for Physical Aspects of Electricity Meters - Safety Standard; 2024.

D. ANSI C12.20 - American National Standard for Electricity Meters - 0.1, 0.2, and 0.5 Accuracy Classes; 2022.

E. ANSI/FCI 70-2 - Control Valve Seat Leakage; 2021.

F. ASHRAE Std 135 - BACnet - A Data Communication Protocol for Building Automation and Control Networks; 2024, with Errata (2025).

G. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).

H. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

I. ASTM B32 - Standard Specification for Solder Metal; 2020.

J. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

K. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

L. ASTM B819 - Standard Specification for Seamless Copper Tube for Medical Gas Systems; 2019.

M. ASTM D1693 - Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics; 2021.

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N. AWWA C700 - Cold-Water Meters -- Displacement Type, Metal Alloy Main Case; 2024.

O. AWWA C707 - Encoder-Type Remote-Registration Systems for Cold-Water Meters; 2022.

P. Bluetooth CS - Bluetooth Core Specification; 2016, Addendum 2017.

Q. FieldComm Group (FFTS) - Foundation Fieldbus Technical Specifications; 2014.

R. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).

S. IEEE 802.3 - IEEE Standard for Ethernet; 2022 (Corrigendum 2024).

T. IEEE 802.11 - IEEE Standard for Information Technology--Telecommunications and Information Exchange between Systems Local and Metropolitan Area Networks--Specific Requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications; 2024, with Amendment (2025).

U. IEEE 802.15.4 - IEEE Standard for Low-Rate Wireless Networks; 2024.

V. LonMark Interoperability Guide - LonMark Application-Layer Interoperability Guide and LonMark Layer 1-6 Interoperability Guide; Version 3.4; 2005.

W. Modbus (PS) - The Modbus Organization Communications Protocol.; Latest Update.

X. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

Y. NEMA BS 31032 - Residential Controls–Electrical Wall-Mounted Room Thermostats; 2025.

Z. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

AA. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

BB. NSF 61 - Drinking Water System Components - Health Effects; 2024.

CC. NSF 372 - Drinking Water System Components - Lead Content; 2024.

DD. ODVA (CIP) - The Common Industrial Protocol (CIP) Standards: EtherNet/IP, DeviceNet, ControlNet, and CompoNet; Current Edition.

EE. ProfiBus/ProfiNet SSG - ProfiBus, ProfiNet, and IO-Link Specifications, Standards and Guidelines; Current Edition.

FF. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances; Current Edition, Including All Revisions.

GG. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.

HH. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.

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1.4 ADMINISTRATIVE REQUIREMENTS

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

B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.

D. Manufacturer's Instructions: Provide for all manufactured components.

E. Designer's qualification statement.

F. Installer's qualification statement.

G. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

H. Project Record Documents: Record actual location of control components, including panels, thermostats, and sensors.

1. Revise shop drawings to reflect actual installation and operating sequences.

I. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in CPL's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

A. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years experience approved by manufacturer.

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1.7 WARRANTY

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

B. Correct defective work within a five year period after Substantial Completion.

C. Provide five year manufacturer's warranty for control air compressors.

PART 2 PRODUCTS

2.1 EQUIPMENT - GENERAL

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.2 CONTROL PANELS

A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face.

B. NEMA EN 10250, general purpose utility enclosures with enameled finished face panel.

C. Provide common keying for all panels.

2.3 CONTROL VALVES

A. Globe Valves with Factory-Mounted Actuators:

1. Up to 2 inches: Bronze body, bronze trim, rising stem, renewable composition disc, screwed ends with backseating capacity repackable under pressure.
2. Over 2 inches: Iron body, bronze trim, rising stem, plug-type disc, flanged ends, renewable seat and disc.
3. Hydronic Systems:
    a. Rate for service pressure of 125 psig at 250 degrees F.
    b. Replaceable plugs and seats of stainless steel.
    c. Provide two-way or three-way valves (see drawings) with equal percentage characteristics and three-way valves with linear characteristics. Size two-way valve operators to close valves against pump shut-off head.

B. Electronic Valve Actuators:

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1. Valves shall spring return to normal position as indicated on freeze, fire, or temperature protection.
2. Select operator for full shut-off at maximum pump differential pressure.

2.4 DAMPERS

A. See Section 23 33 00 for dampers and this section for actuators and operators.

2.5 DAMPER OPERATORS

A. General:
1. Provide actuators with torque capacity sized for minimum of 20 percent greater than maximum design stream velocity and hold tight seal against maximum system pressures.
2. Provide spring return for two position control and for fail safe operation.
3. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
4. Provide one operator for maximum 36 sq ft damper section.
5. See Section 25 35 13 for field-mount damper actuators and operators.

B. Electric Operators:
1. Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch and and 24 V dc, 24 va transformer.

2.6 HUMIDISTATS

A. Room Humidistats:
1. Wall mounted, proportioning type.
2. Throttling Range: Adjustable 2 percent relative humidity.
3. Operating Range: 30 to 80 percent.
4. Cover: Set point indication.

2.7 WALL-, SURFACE-, AND DUCT-MOUNT SENSORS

A. Temperature Sensors:

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1. Use thermistor or RTD type temperature sensing elements with characteristics resistant to moisture, vibration, and other conditions consistent with the application without affecting accuracy and life expectancy.
2. Construct RTD of nickel or platinum with base resistance of 1000 ohms at 70 degrees F.
3. 100 ohm platinum RTD is acceptable if used with project DDC controllers.
4. Temperature Sensing Device: Compatible with project DDC controllers.
5. Performance Characteristics:
    a. RTD:
        1) Room Sensor Accuracy: Plus/minus 0.50 degrees F minimum.
        2) Duct Averaging Accuracy: Plus/minus 0.50 degrees F minimum.
        3) Chilled Water Accuracy: Plus/minus 0.50 degrees F minimum.
        4) All Other Accuracy: Plus/minus 0.75 degrees F minimum.
        5) Range: Minus 40 degrees F through 220 degrees F minimum.
    b. Temperature Transmitter:
        1) Accuracy: 0.10 degree F minimum or plus/minus 0.20 percent of span.
        2) Output: 4 to 20 mA.
    c. Sensing Range:
        1) Provide limited range sensors if required to sense the range expected for a respective point.
        2) Use RTD type sensors for extended ranges beyond minus 30 to 230 degrees F.
        3) Use temperature transmitters in conjunction with RTDs when RTDs are incompatible with DDC controller direct temperature input.
    d. Wire Resistance:
        1) Use appropriate wire size to limit temperature offset due to wire resistance to 1.0 degree F or use temperature transmitter when offset is greater than 1.0 degree F due to wire resistance.
        2) Compensate for wire resistance in software input definition when feature is available in the DDC controller.
    e. Room Sensors: Locking cover matching the pneumatic thermostats used.
    f. Outside Air Sensors: Watertight inlet fitting shielded from direct rays of the sun.
    g. Room Temperature Sensors with Integral Digital Display:
        1) Provide a four button keypad with the following capabilities:

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(a) Indication of space and outdoor temperatures.

(b) Setpoint adjustment to accommodate room setpoint, DDC Input/Output Points List, and Sequence of Operation.

(c) Display and control fan operation status.

(d) Manual occupancy override and indication of occupancy status.

(e) Controller mode status.

(f) Password enabled setpoint and override modes.

B. Humidity Sensors, Outdoor-Mount:

1. Digitally profiled thin-film capacitive sensor encased in a die-cast metal, weather-proof plastic or metal housing with solar shield.
2. Measuring Scale: 0 to 100 percent RH, noncondensing, temperature compensated.
3. Hardwired Output: Two-wire, 4 to 20 mA, loop powered.
4. Accuracy: Plus/minus 1 percent between 20 to 40 percent RH linear range, NIST traceable with multi-point calibration.

C. Humidity Transmitters, Surface-Mounted:

1. Plastic housing encased, wall-mounted, humidity and temperature indicating sensor.
2. Humidity Sensor Type: Thin-film capacitive.
3. Accuracy: 1 percent at rated measuring scale and capable of withstanding 95 percent relative humidity without loss of calibration.
4. Output: Two-wire, 4 to 20 mA, 0 to 5 VDC or 0 to 10 VDC, non-loop powered, selectable.

D. Building Static Pressure Transmitters:

1. Single port for direct or tubing connection into wall or ceiling static pressure tip, direct acting, double bell, scale range 0.01 to 6.0 in-wc positive or negative, and sensitivity of 0.0005 in-wc. Transmit electronic signal to receiver with matching scale range.

E. Static-Air Pressure Sensors:

1. Unidirectional with ranges not exceeding 150 percent of maximum expected input.
2. Temperature compensate with typical thermal error or 0.06 percent of full scale in temperature range of 40 to 100 degrees F.
3. Accuracy: One percent of full scale with repeatability 0.3 percent.
4. Output: 0 to 5 vdc with power at 12 to 28 vdc.

F. Air Pressure Transmitters:

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1. General: Provide dry air media, differential pressure transducers to monitor duct and room pressure.
2. Accuracy: Plus/minus 2 percent full scale of range with combined linearity and hysteresis.
3. Zero Adjust: Pushbutton auto-zero and digital input using 2-position terminal block.
4. Measuring Range: 1 to 10 in-wc, unidirectional or bidirectional.
5. Response Time: 2 seconds, adjustable.
6. Hardwired Output: 2-wire, loop-powered 4 to 20 mA, field selectable.
7. Service Temperature: 32 to 122 degrees F.
8. Proof and Burst Pressure (pressure differential): 3 and 5 psid.
9. Fittings: Brass barb, UL 94 V-O fire retardant ABS, 0.24 inches outer diameter.

G. Airflow Meters; Thermal Dispersion:

1. Manufacturers:
   a. Air Monitor, a brand of Onicon, Inc; ELECTRA-Flo Series: www.onicon.com/#sle.
   b. Ebtron, Inc; _____: www.ebtron.com/#sle.
2. Configuration: Duct or plenum inserted assembly using up to eight water-resistant thermal dispersion sensors per metal probe wired into external access box holding self-diagnosing sensor interface electronics with respective field wire and cable landing terminals.
3. Provide thermal dispersion flow meters complete with matched transducers, self aligning installation hardware, and transducer cables.
4. Optimize thermal dispersion transducer for the specific duct or pipe and process conditions for the application.
5. Signal Monitoring Range:
   a. Air Velocity: 0 to 2000 fpm, bidirectional converted to airflow using section area and air velocity from listed range.
   b. Temperature: 32 to 104 degrees F.
   c. Humidity: 5 to 95 percent RH, noncondensing.
   d. Dewpoint Temperature: Calculate using temperature and humidity signal.
   e. Enthalpy: Calculate using temperature and humidity signal.
6. Accuracy: Plus or minus 1 percent, NIST with a plus or minus 0.25 percent repeatability over listed range. Include means to zero, adjust, and calibrate outputs.

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7. Access Box: NEMA EN 10250, Type 1 with hinged cover housing and cable access ports.
8. Interface: Fitted with 16-character, 2-line, backlit, alphanumeric display and labeled pad-type surface membrane buttons.
9. Controller: Fitted with factory-installed module to handle up to 16 external ancillary probes to form an extended measuring probe array for custom duct or plenum sizes.
10. Outputs: Two-wire, 4 to 20 mA, for each measured signal, configurable.

H. Damper Position Indicators: Potentiometer mounted in enclosure with adjustable crank arm assembly connected to damper to transmit 0 to 100 percent damper travel.

I. R-454B Refrigerant Sensors:

1. Gas sensing module that holds fixed or replaceable refrigerant gas-sensor cartridge.
2. Form Factor: IEC 60529, IP20 enclosure, single-gang electrical box mounted.
3. Electromechanical sensor with 0 to 2,000 ppm measurement range.
4. Accuracy: Plus/minus two percent of range with 1 ppm resolution.
5. Hardwired Output: Three-wire, 4 to 20 mA, loop powered.
6. Alarm: Auxiliary dry contact relay driven by setpoint adjustable between 100 to 500 ppm.
7. Service Temperature: Minus 4 to 122 degrees F.
8. Service Humidity: 0 to 90 percent RH, noncondensing.

2.8 THERMOSTATS

A. Electric Thermostats:

1. Type: NEMA BS 31032, 24 volts, with setback/setup temperature control.
2. Service: Cooling only.
3. Covers: Locking with set point adjustment, with thermometer.

B. Freezestats:

1. Configuration: Vapor-filled capillary.
2. Probe Sensing Length: 20 feet.
3. Setpoint Adjust Control: Screw with manual reset switch.
4. Switch Type: SPDT, snap-action, form C in dust-protected enclosure.
5. Mounting: Locate on cooling coil intake side.
6. Field Interface: Connect load line-voltage to starter.

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7. Electrical Rating: As indicated on drawings.

2.9 FAN AND PUMP MOTOR RUN-STATUS MONITORING

A. Current Switches:

1. Maximum AC Current Monitoring Value: As indicated on drawings.

B. Current Transducers: See Section 25 36 19 for analog output, current monitoring devices.

2.10 PIPE-MOUNTED SENSORS AND TRANSMITTERS

A. Temperature Sensors:

1. Pipe-mounted temperature probe tied to weather-resistant enclosure for direct insertion into compatible liquids or gases or inserted into intermediary thermal grease-filled pipe-well compatible with interfaced fluid.
2. Sensor Type: 1,000 ohm Platinum RTD.
3. Transmitter: Fitted within probe-interface enclosure, calibrated.
    a. Monitoring Range: 32 to 122 degrees F, adjustable.
    b. Hardwired Output: Two-wire, 4 to 20 mA, loop powered.
    c. Accuracy: Plus/minus three percent. adjustable on the transmitter end.

B. Pressure Transmitters:

1. Self-contained transducer for monitoring of pneumatic, gas, liquid, or steam service with proportional range scaled over selected electronic output.
2. Service Monitoring Range: 0 to 15 psig.
3. Wetted Material: Brass for general service or stainless steel for steam and corrosive.
4. Hardwired Output: Two-wire, 4 to 20 mA, loop powered.
5. Accessories: Provide gauge-port plug, isolation ball valve, and snubber.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that systems are ready to receive work.

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C. Beginning of installation means installer accepts existing conditions.

D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

F. Ensure installation of components is complementary to installation of similar components.

G. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check and verify location of thermostats with plans and room details before installation. Locate 60 inches above floor. Align with lighting switches and humidistats; see Section 26 27 26.

C. Mount freeze protection thermostats using flanges and element holders.

D. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.

E. Provide separable sockets for liquids and flanges for air bulb elements.

F. Provide valves with position indicators and with pilot positioners where sequenced with other controls.

G. Provide separate steam valves for each bank of coils. Provide two valves in parallel where steam load exceeds 1,500 lb/hr with 1/3 to 2/3 load capacities sequenced with smaller valve opening first.

H. Provide mixing dampers of opposed blade construction arranged to mix streams. Provide pilot positioners on mixed air damper motors.

I. Provide isolation (two-position) dampers of parallel blade construction.

J. Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.

K. Mount control panels adjacent to associated equipment on vibration free walls or free-standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

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L. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.

M. Provide conduit and electrical wiring in accordance with Section 26 05 83. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

3.3 MAINTENANCE

A. Provide service and maintenance of control system for one year from Date of Substantial Completion.

B. Provide complete service of controls systems, including call backs, and submit written report of each service call.

C. In addition to normal service calls, make minimum of ____ complete normal inspections of approximately ____ hours duration to inspect, calibrate, and adjust controls.

END OF SECTION 23 09 13

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SECTION 23 09 23 - DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. System description.

B. Controllers.

C. Power supplies and line filtering.

D. Controller software.

E. HVAC control programs.

1.2 RELATED REQUIREMENTS

A. Section 23 09 13 - Instrumentation and Control Devices for HVAC.

B. Section 23 09 93 - Sequence of Operations for HVAC Controls.

C. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. ASHRAE Std 135 - BACnet - A Data Communication Protocol for Building Automation and Control Networks; 2024, with Errata (2025).

B. ASHRAE Std 147 - Reducing the Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Equipment and Systems; 2019, with Addendum (2025).

C. Bluetooth CS - Bluetooth Core Specification; 2016, Addendum 2017.

D. CTA-709.1 - Control Network Protocol Specification; 2019.

E. IEEE 802.11 - IEEE Standard for Information Technology--Telecommunications and Information Exchange between Systems Local and Metropolitan Area Networks--Specific Requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications; 2024, with Amendment (2025).

F. IEEE 802.15.4 - IEEE Standard for Low-Rate Wireless Networks; 2024.

G. LonMark Interoperability Guide - LonMark Application-Layer Interoperability Guide and LonMark Layer 1-6 Interoperability Guide; Version 3.4; 2005.

H. LonMark SCPT List - LonMark SCPT Master List; Version 15; 2014.

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I. LonMark SNVT List - LonMark SNVT Master List; Version 15; 2014.

J. MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests; 2019h, with Editorial Revision (2022).

K. Modbus (PS) - The Modbus Organization Communications Protocol.; Latest Update.

L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. UL (DIR) - Online Certifications Directory; Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

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

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for each system component and software module.

C. Shop Drawings:

1. Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.
2. List connected data points, including connected control unit and input device.
3. Indicate system graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations. Provide demonstration digital media containing graphics.
4. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
5. Indicate description and sequence of operation of operating, user, and application software.

D. Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.

E. Designer's Qualification Statement.

F. Manufacturer's Qualification Statement.

G. Installer's Qualification Statement.

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H. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.

1. Revise shop drawings to reflect actual installation and operating sequences.

2. Include submittals data in final "Record Documents" form.

I. Operation and Maintenance Data:

1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.

2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.

3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

J. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in CPL s name and registered with manufacturer.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with NFPA 70.

B. Designer Qualifications: Perform design of system using manufacturer's software under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

D. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.

E. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for purpose specified and indicated.

1.7 WARRANTY

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

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

C. Provide five year manufacturer's warranty for field programmable micro-processor based units.

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1.8 PROTECTION OF SOFTWARE RIGHTS

A. Prior to delivery of software, the CPL and the party providing the software will enter into a software license agreement with provisions for the following:

1. Limiting use of software to equipment provided under these specifications.
2. Limiting copying.
3. Preserving confidentiality.
4. Prohibiting transfer to a third party.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Siemens AG, Building Technologies Division; _____: www.siemens.com/#sle.

2.2 SYSTEM DESCRIPTION

A. Automatic temperature control field monitoring and control system using field programmable micro-processor based units.

B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.

C. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

D. Controls for variable air volume terminals, radiation, reheat coils, unit heaters, fan coils, and the like when directly connected to the control units. Individual terminal unit control is specified in Section 23 09 13.

E. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

F. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

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2.3 CONTROLLERS

A. Building Controllers:

1. General:

a. Manage global strategies by one or more, independent, standalone, microprocessor based controllers.

b. Provide sufficient memory to support controller's operating system, database, and programming requirements.

c. Share data between networked controllers.

d. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.

e. Utilize real-time clock for scheduling.

f. Continuously check processor status and memory circuits for abnormal operation.

g. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.

h. Communication with other network devices to be based on assigned protocol.

2. Communication:

a. Controller to reside on a BACnet network using ISO 8802-3 (ETHERNET) Data Link/Physical layer protocol.

b. Perform routing when connected to a network of custom application and application specific controllers.

c. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.

3. External Input-Output (I-O) Data Bus:

a. Input only modules.

b. Output only modules.

c. Variable frequency drives (VFD's).

d. Universal I-O module (configurable).

e. Access control module for single door.

f. Specific wired and wireless data integration modules.

g. Motor control of devices like blinds, roller shutters, and sun protection systems.

h. Multiple Input Output (I-O) Module:

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1) IAQ: Temperature, humidity, and CO2.
2) Audio: Microphone, tone generator, and speaker.
3) Input and output terminals to monitor or control local devices.
4) Occupancy: Light and thermal sensing with multi-colored LED feedback.

4. Anticipated Environmental Ambient Conditions:
   a. Outdoors and/or in Wet Ambient Conditions:
      1) Mount within waterproof enclosures.
      2) Rated for operation at 40 to 150 degrees F.
   b. Conditioned Space:
      1) Mount within dustproof enclosures.
      2) Rated for operation at 32 to 120 degrees F.
5. Provisions for Serviceability:
   a. Diagnostic LEDs for power, communication, and processor.
   b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
6. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
7. Power and Noise Immunity:
   a. Maintain operation at 90 to 110 percent of nominal voltage rating.
   b. Perform orderly shutdown below 80 percent of nominal voltage.
   c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

B. Application Specific Controllers:
1. General:
   a. Not fully user programmable, microprocessor based controllers dedicated to control specific equipment.
   b. Customized for operation within the confines of equipment served.
   c. Communication with other network devices to be based on assigned protocol.
2. Communication:
   a. Controller to reside on a BACnet network using MS/TP Data Link/Physical layer protocol.

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b. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.

3. Anticipated Environmental Ambient Conditions:

a. Outdoors and/or in Wet Ambient Conditions:

1) Mount within waterproof enclosures.

2) Rated for operation at 40 to 150 degrees F.

b. Conditioned Space:

1) Mount within dustproof enclosures.

2) Rated for operation at 32 to 120 degrees F.

4. Provisions for Serviceability:

a. Diagnostic LEDs for power, communication, and processor.

b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.

5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.

6. Power and Noise Immunity:

a. Maintain operation at 90 to 110 percent of nominal voltage rating.

b. Perform orderly shutdown below 80 percent of nominal voltage.

c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3 feet.

C. Input/Output Interface:

1. Hardwired inputs and outputs tie into the DDC system through building, custom application, or application specific controllers.

2. All Input/Output Points:

a. Protect controller from damage resulting from any point short-circuiting or grounding and from voltage up to 24 volts of any duration.

b. Provide universal type for building and custom application controllers where input or output is software designated as either binary or analog type with appropriate properties.

3. Binary Inputs:

a. Allow monitoring of On/Off signals from remote devices.

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b. Provide wetting current of 12 mA minimum, compatible with commonly available control devices and protected against the effects of contact bounce and noise.

c. Sense dry contact closure with power provided only by the controller.

4. Pulse Accumulation Input Objects: Comply with all requirements of binary input objects and accept up to 10 pulses per second.

5. Analog Inputs:

a. Allow for monitoring of low voltage 0 to 10 VDC, 4 to 20 mA current, or resistance signals (thermistor, RTD).

b. Compatible with and field configurable to commonly available sensing devices.

6. Binary Outputs:

a. Used for On/Off operation or a pulsed low-voltage signal for pulse width modulation control.

b. Outputs provided with three position (On/Off/Auto) override switches.

c. Status lights for building and custom application controllers to be selectable for normally open or normally closed operation.

7. Analog Outputs:

a. Monitoring signal provides a 0 to 10 VDC or a 4 to 20 mA output signal for end device control.

b. Provide status lights and two position (AUTO/MANUAL) switch for building and custom application controllers with manually adjustable potentiometer for manual override on building and custom application controllers.

c. Drift to not exceed 0.4 percent of range per year.

8. Tri State Outputs:

a. Coordinate two binary outputs to control three point, floating type, electronic actuators without feedback.

b. Limit the use of three point, floating devices to the following zone and terminal unit control applications:

c. Control algorithms run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.

9. System Object Capacity:

a. System size to be expandable to twice the number of input output objects required by providing additional controllers, including associated devices and wiring.

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b. Hardware additions or software revisions for the installed operator interfaces are not to be required for future, system expansions.

2.4 POWER SUPPLIES AND LINE FILTERING

A. Power Supplies:

1. Provide UL listed control transformers with Class 2 current limiting type or over-current protection in both primary and secondary circuits for Class 2 service as required by the NEC.
2. Limit connected loads to 80 percent of rated capacity.
3. Match DC power supply to current output and voltage requirements.
4. Unit to be full wave rectifier type with output ripple of 5.0 mV maximum peak to peak.
5. Regulation to be 1 percent combined line and load with 100 microsecond response time for 50 percent load changes.
6. Provide over-voltage and over-current protection to withstand a 150 percent current overload for 3 seconds minimum without trip-out or failure.
7. Operational Ambient Conditions: 32 to 120 degrees F.
8. EM/RF meets FCC Class B and VDE 0871 for Class B and MIL-STD-810 for shock and vibration.
9. Line voltage units UL recognized and CSA approved.

B. Power Line Filtering:

1. Provide external or internal transient voltage and surge suppression component for all workstations and controllers.
2. Minimum surge protection attributes:
   a. Dielectric strength of 1000 volts minimum.
   b. Response time of 10 nanoseconds or less.
   c. Transverse mode noise attenuation of 65 dB or greater.
   d. Common mode noise attenuation of 150 dB or greater at 40 to 100 Hz.

2.5 LOCAL AREA NETWORK (LAN)

A. Provide communication between control units over local area network (LAN).

B. LAN Capacity: Not less than 60 stations or nodes.

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C. Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.

D. LAN Data Speed: Minimum 19.2 Kb.

E. Communication Techniques: Allow interface into network by multiple operation stations and by auto-answer/auto-dial modems. Support communication over telephone lines utilizing modems.

F. Transmission Median: Fiber optic or single pair of solid 24 gauge twisted, shielded copper cable.

G. Network Support: Time for global point to be received by any station, shall be less than 3 seconds. Provide automatic reconfiguration if any station is added or lost. If transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.

2.6 CONTROLLER SOFTWARE

A. All applications reside and operate in the system controllers and editing of all applications occurs at the operator workstation.

B. System Security:

1. User access secured via user passwords and user names.
2. Passwords restrict user to the objects, applications, and system functions as assigned by the system manager.
3. User Log On/Log Off attempts are recorded.
4. Automatic Log Off occurs following the last keystroke after a user defined delay time.

C. Object or Object Group Scheduling:

1. Weekly Schedules Based on Separate, Daily Schedules:
    a. Include start, stop, optimal stop, and night economizer.
    b. 10 events maximum per schedule.
    c. Start/stop times adjustable for each group object.

D. Provide standard application for equipment coordination and grouping based on function and location to be used for scheduling and other applications.

E. Alarms:

1. Binary object is set to alarm based on the operator specified state.
2. Analog object to have high/low alarm limits.
3. All alarming is capable of being automatically and manually disabled.

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4. Alarm Reporting:
    a. Operator determines action to be taken for alarm event.
    b. Alarms to be routed to appropriate workstation.
    c. Reporting Options:
        1) Start programs.
        2) Print.
        3) Logged.
        4) Custom messaging.
        5) Graphical displays.
        6) Dial out to workstation receivers via system protocol.

F. Maintenance Management: System monitors equipment status and generates maintenance messages based upon user-designated run-time limits.

G. Sequencing: Application software based upon specified sequences of operation in Section 23 09 93.

H. PID Control Characteristics:
1. Direct or reverse action.
2. Anti-windup.
3. Calculated, time-varying, analog value, positions an output or stages a series of outputs.
4. User selectable controlled variable, set-point, and PED gains.

I. Staggered Start Application:
1. Prevents all controlled equipment from simultaneously restarting after power outage.
2. Order of equipment startup is user selectable.

J. Energy Calculations:
1. Accumulated instantaneous power or flow rates are converted to energy use data.
2. Algorithm calculates a rolling average and allows window of time to be user specified in minute intervals.
3. Algorithm calculates a fixed window average with a digital input signal from a utility meter defining the start of the window period that in turn synchronizes the fixed-window average with that used by the power company.

K. Anti-Short Cycling:
1. All binary output objects protected from short-cycling.

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2. Allows minimum on-time and off-time to be selected.

L. On-Off Control with Differential:

1. Algorithm allows binary output to be cycled based on a controlled variable and set-point.
2. Algorithm to be direct-acting or reverse-acting incorporating an adjustable differential.

M. Run-Time Totalization:

1. Totalize run-times for all binary input objects.
2. Provides operator with capability to assign high run-time alarm.

2.7 HVAC CONTROL PROGRAMS

A. General:

1. Support Inch-pounds and SI (metric) units of measurement.
2. Identify each HVAC Control system.

B. Optimal Run Time:

1. Control start-up and shutdown times of HVAC equipment for both heating and cooling.
2. Base on occupancy schedules, outside air temperature, seasonal requirements, and interior room mass temperature.
3. Start-up systems by using outside air temperature, room mass temperatures, and adaptive model prediction for how long building takes to warm up or cool down under different conditions.
4. Use outside air temperature to determine early shut down with ventilation override.
5. Analyze multiple building mass sensors to determine seasonal mode and worse case condition for each day.
6. Operator commands:
    a. Define term schedule.
    b. Add/delete fan status point.
    c. Add/delete outside air temperature point.
    d. Add/delete mass temperature point.
    e. Define heating/cooling parameters.
    f. Define mass sensor heating/cooling parameters.
    g. Lock/unlock program.
    h. Request optimal run time control summary.

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i. Request optimal run time mass temperature summary.

j. Request HVAC point summary.

k. Request HVAC saving profile summary.

7. Control Summary:

a. HVAC Control system begin/end status.

b. Optimal run time lock/unlock control status.

c. Heating/cooling mode status.

d. Optimal run time schedule.

e. Start/Stop times.

f. Selected mass temperature point ID.

g. Optimal run time system normal start times.

h. Occupancy and vacancy times.

i. Optimal run time system heating/cooling mode parameters.

8. Mass temperature summary:

a. Mass temperature point type and ID.

b. Desired and current mass temperature values.

c. Calculated warm-up/cool-down time for each mass temperature.

d. Heating/cooling season limits.

e. Break point temperature for cooling mode analysis.

9. HVAC point summary:

a. Control system identifier and status.

b. Point ID and status.

c. Outside air temperature point ID and status.

d. Mass temperature point ID and point.

e. Calculated optimal start and stop times.

f. Period start.

C. Supply Air Reset:

1. Monitor heating and cooling loads in building spaces, terminal reheat systems, both hot deck and cold deck temperatures on dual duct and multizone systems, single zone unit discharge temperatures.

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2. Adjust discharge temperatures to most energy efficient levels satisfying measured load by:
    a. Raising cooling temperatures to highest possible value.
    b. Reducing heating temperatures to lowest possible level.
3. Operator commands:
    a. Add/delete fan status point.
    b. Lock/unlock program.
    c. Request HVAC point summary.
    d. Add/Delete discharge controller point.
    e. Define discharge controller parameters.
    f. Add/delete air flow rate.
    g. Define space load and load parameters.
    h. Request space load summary.
4. Control summary:
    a. HVAC control system status (begin/end).
    b. Supply air reset system status.
    c. Optimal run time system status.
    d. Heating and cooling loop.
    e. High/low limits.
    f. Deadband.
    g. Response timer.
    h. Reset times.
5. Space load summary:
    a. HVAC system status.
    b. Optimal run time status.
    c. Heating/cooling loop status.
    d. Space load point ID.
    e. Current space load point value.
    f. Control heat/cool limited.
    g. Gain factor.

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h. Calculated reset values.

i. Fan status point ID and status.

j. Control discharge temperature point ID and status.

k. Space load point ID and status.

l. Air flow rate point ID and status.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.2 INSTALLATION

A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

B. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 23 09 93.

C. Provide with 120v AC, 15 amp dedicated emergency power circuit to each programmable control unit.

D. Provide conduit and electrical wiring in accordance with Section 26 05 83. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

3.3 MANUFACTURER'S FIELD SERVICES

A. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

B. Provide service engineer to instruct CPL's representative in operation of systems plant and equipment for 3 day period.

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C. Provide basic operator training for 5 persons on data display, alarm and status descriptors, requesting data, execution of commands and request of logs. Include a minimum of 40 hours dedicated instructor time. Provide training on site.

3.4 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate complete and operating system to CPL.

3.5 MAINTENANCE

A. Provide service and maintenance of energy management and control systems for one years from Date of Substantial Completion.

B. Provide two complete inspections, one in each season, to inspect, calibrate, and adjust controls as required, and submit written reports.

C. Provide complete service of systems, including call backs. Make minimum of ____ complete normal inspections of approximately ____ hours duration in addition to normal service calls to inspect, calibrate, and adjust controls, and submit written reports.

END OF SECTION 23 09 23

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SECTION 23 11 23 - FACILITY NATURAL-GAS PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for natural gas piping systems.

1.2 RELATED REQUIREMENTS

A. Section 08 31 00 - Access Doors and Panels.

B. Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping.

C. Section 23 05 48 - Vibration and Seismic Controls for HVAC.

D. Section 23 05 53 - Identification for HVAC Piping and Equipment.

E. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

F. Section 33 52 16 - Gas Hydrocarbon Piping.

1.3 REFERENCE STANDARDS

A. ANSI LC 1/CSA 6.26 - Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing; 2023.

B. ANSI LC 4/CSA 6.32 - Press-Connect Metallic Fittings and Valves for Use in Fuel Gas Distribution Systems; 2022.

C. ANSI Z21.18/CSA 6.3 - Gas Appliance Pressure Regulators; 2019.

D. ANSI Z21.80/CSA 6.22 - Line Pressure Regulators; 2019.

E. ANSI Z223.1 - National Fuel Gas Code; 2024.

F. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2025, with Errata.

G. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.

H. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

I. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

J. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2024.

K. ASME B31.1 - Power Piping; 2024.

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L. ASME B31.9 - Building Services Piping; 2025.

M. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

N. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.

O. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

P. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2025.

Q. ASTM B68/B68M - Standard Specification for Seamless Copper Tube, Bright Annealed; 2025.

R. ASTM B75/B75M - Standard Specification for Seamless Copper Tube; 2020.

S. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

T. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

U. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2023.

V. ASTM B813 - Standard Specification for Water Flushable Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2024.

W. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2023.

X. ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings; 2026.

Y. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing; 2020.

Z. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

AA. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 2024.

BB. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.

CC. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Errata (2026).

DD. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.

EE. AWWA C606 - Grooved and Shouldered Joints; 2022.

FF. IAPMO (UMC) - 2024 Uniform Mechanical Code; 2024.

GG. IAPMO (UPC) - Uniform Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

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HH. ICC (IFGC) - International Fuel Gas Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

II. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2018, with Editorial Revision (2020).

JJ. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry; 2018, with Editorial Revision (2020).

KK. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2017, with Editorial Revision (2020).

LL. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2023.

MM. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2025.

NN. MSS SP-78 - Gray Iron Plug Valves, Flanged and Threaded Ends; 2011.

OO. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.

D. Project Record Documents: Record actual locations of valves.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

D. Identify pipe with marking including size, ASTM material classification, and ASTM specification.

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1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.7 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.1 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Steel Pipe: ASTM A53/A53M, Grade B, Type F, Schedule 40 black.

1. Fittings: ASTM A234/A234M, wrought steel welding type.
2. Joints: ANSI Z223.1, welded.
3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

2.2 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Grade B, Type F, Schedule 40 black.

1. Manufacturers:
   a. Borusan Pipe U.S.: borusanpipeusa.com/#sle.
   b. Wheatland Tube Company; _____: www.wheatland.com/#sle.
2. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
3. Joints: Threaded or welded to ASME B31.1.
4. Mechanical Press Sealed Fittings: ANSI LC 4/CSA 6.32; ICC (IFGC) approved, and IAPMO (UPC) or IAPMO (UMC) approved, with HNBR seals.

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a. Manufacturers:

1) Mueller Streamline, Co; STL-G: www.muellerstreamline.com/#sle.

2) NIBCO INC; BenchPressG: www.nibco.com/#sle.

2.3 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:

1. Ferrous Pipe: Class 150 malleable iron threaded unions.

2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 1 Inch:

1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.

2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

2.4 PLUG VALVES

A. Construction 2-1/2 Inches and Larger: MSS SP-78, 175 psi CWP, cast iron body and plug, pressure lubricated, Teflon or Buna N packing, flanged or grooved ends. Provide lever operator with set screw.

2.5 STRAINERS

A. Manufacturers:

1. Armstrong International, Inc; _____: www.armstronginternational.com/#sle.

2. Green Country Filter Manufacturing; _____: www.greencountryfilter.com/#sle.

3. NIBCO INC: www.nibco.com/#sle.

4. WEAMCO; _____: www.weamco.com/#sle.

B. Size 2 inch and Under:

1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

C. Size 1-1/2 inch to 4 inch:

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1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.

D. Size 5 inch and Larger:

1. Class 125, flanged iron body, basket pattern with 1/8 inch stainless steel perforated screen.

2.6 LINE PRESSURE REGULATORS AND APPLIANCE REGULATORS INDICATORS

A. Compliance Requirements:

1. Appliance Regulator: ANSI Z21.18/CSA 6.3.
2. Line Pressure Regulator: ANSI Z21.80/CSA 6.22.

B. Materials in Contact With Gas:

1. Housing: Aluminum, steel (free of non-ferrous metals).
2. Seals and Diaphragms: NBR-based rubber.

C. Maximum Inlet Operating Pressure: 10 psi.

1. Appliance Regulator: 10 psi.
2. Line Pressure Regulator: 10 psi.

D. Maximum Body Pressure: 10 psi.

E. Output Pressure Range: 1 inch wc to 80 inch wc.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

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3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

H. Provide access where valves and fittings are not exposed.

1. Coordinate size and location of access doors with Section 08 31 00.

I. Install vent piping penetrating roofed areas to maintain integrity of roof assembly;.

J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

K. Provide support for utility meters in accordance with requirements of utility companies.

L. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.

M. Install valves with stems upright or horizontal, not inverted.

N. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.

O. Sleeve pipes passing through partitions, walls and floors.

P. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9.

2. Support horizontal piping as indicated.

3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

4. Place hangers within 12 inches of each horizontal elbow.

5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.

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7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

3.4 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

D. Install ball valves for throttling, bypass, or manual flow control services.

E. Provide plug valves in natural gas systems for shut-off service.

3.5 SERVICE CONNECTIONS

A. Provide new gas service complete with gas meter and regulators in accordance with Section 33 52 16. Gas service distribution piping to have initial minimum pressure of 7 inch wg. Provide regulators on each line serving gravity type appliances, sized in accordance with equipment.

END OF SECTION 23 11 23

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SECTION 23 21 13 - HYDRONIC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Hydronic system requirements.

B. Heating water piping, buried.

C. Heating water and glycol piping, buried.

D. Heating water piping, above grade.

E. Heating water and glycol piping, above grade.

F. Equipment drains and overflows.

G. Unions, flanges, mechanical couplings, and dielectric connections.

1.2 RELATED REQUIREMENTS

A. Section 08 31 00 - Access Doors and Panels.

B. Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping.

C. Section 23 05 23 - General-Duty Valves for HVAC Piping.

D. Section 23 05 48 - Vibration and Seismic Controls for HVAC.

E. Section 23 05 53 - Identification for HVAC Piping and Equipment.

F. Section 23 07 19 - HVAC Piping Insulation.

G. Section 23 21 14 - Hydronic Specialties.

H. Section 23 25 00 - HVAC Water Treatment: Pipe cleaning.

1.3 REFERENCE STANDARDS

A. ANSI/FCI 70-2 - Control Valve Seat Leakage; 2021.

B. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2025, with Errata.

C. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.

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D. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard; 2025.

E. ASME B16.15 - Cast Copper Alloy Threaded Fittings: Classes 125 and 250; 2024.

F. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

G. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

H. ASME B16.34 - Valves — Flanged, Threaded, and Welding End; 2025.

I. ASME B16.51 - Copper and Copper Alloy Press-Connect Pressure Fittings; 2021.

J. ASME B31.9 - Building Services Piping; 2025.

K. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.

L. ASTM A106/A106M - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service; 2019a.

M. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

N. ASTM A183 - Standard Specification for Carbon Steel Track Bolts and Nuts; 2014 (Reapproved 2020).

O. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2025.

P. ASTM A536 - Standard Specification for Ductile Iron Castings; 2024.

Q. ASTM B32 - Standard Specification for Solder Metal; 2020.

R. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

S. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

T. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2021a.

U. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications; 2018, with Editorial Revision (2024).

V. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings; 2022.

W. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2025a.

X. ASTM D2310 - Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe; 2006 (Reapproved 2012).

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Y. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2024.

Z. ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80; 2024.

AA. ASTM D2680 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping; 2020 (Reapproved 2025).

BB. ASTM D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping; 2025.

CC. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2020 (Reapproved 2024).

DD. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40; 2023.

EE. ASTM F439 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2024.

FF. ASTM F441/F441M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80; 2023.

GG. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings; 2022.

HH. ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-Linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing; 2024.

II. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 2024.

JJ. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing; 2025.

KK. ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems; 2025.

LL. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications; 2007 (Reapproved 2024).

MM. ASTM F2389 - Standard Specification for Pressure-Rated Polypropylene (PP) Piping Systems; 2024a.

NN. ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-Linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing; 2024.

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OO. ASTM F3226/F3226M - Standard Specification for Metallic Press-Connect Fittings for Piping and Tubing Systems; 2019 (Reaffirmed 2024).

PP. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.

QQ. AWS D10.12M/D10.12 - Guide for Welding Mild Steel Pipe; 2000.

RR. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.

SS. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2021.

TT. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2023.

UU. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2023.

VV. AWWA C606 - Grooved and Shouldered Joints; 2022.

WW. DIN 4726 - Warm Water Surface Heating Systems and Radiator Connections - Plastics and Multilayer Piping Systems; 2024.

XX. IAPMO (UMC) - 2024 Uniform Mechanical Code; 2024.

YY. IAPMO/ANSI/CAN Z1117 - Standard for Press Connections; 2022.

ZZ. ICC (IMC) - International Mechanical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

AAA. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2025.

BBB. PPI TR-4 - PPI HSB Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB) and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe; 2024.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of the system with size, location and installation of service utilities.

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

C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Welders Certificate: Include welders certification of compliance with ASME BPVC-IX.

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C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

D. Project Record Documents: Record actual locations of valves.

E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

F. Maintenance Materials: Furnish the following for CPL's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.6 QUALITY ASSURANCE

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

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with minimum 3 years of experience.

C. Provide all grooved joint couplings, fittings, valves, specialties, and grooving tools from a single manufacturer.

D. Date stamp all castings used for coupling housings, fittings, valve bodies, etc. for quality assurance and traceability.

E. Coupling Manufacturer:

1. Periodic job site visits by factory-trained representative to ensure best practices in grooved joint installation.

2. A distributor's representative is not considered qualified to perform the training.

F. Welder Qualifications: Certify in accordance with ASME BPVC-IX.

1. Provide certificate of compliance from authority having jurisdiction, indicating approval of welders.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

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1.8 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.1 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers, and supports as required, as indicated, and as follows:

1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
3. Grooved mechanical joints are required in accessible locations and not permitted in other locations.
    a. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as approved by Engineer.
    b. Grooved mechanical connections and joints comply with AWWA C606.
        1) Ductile Iron: Comply with ASTM A536, Grade 65-45-12.
        2) Steel: Comply with ASTM A106/A106M, Grade B or ASTM A53/A53M.
    c. Use rigid joints unless otherwise indicated.
    d. Depending on pipe size, three or four flexible joints may be used in lieu of a flexible connector.
    e. Use gaskets of molded synthetic rubber with central cavity, pressure-responsive configuration, and complying with ASTM D2000, Grade 2CA615A15B44F17Z for circulating medium up to maximum 230 degrees F or Grade M3BA610A15B44Z for circulating medium up to maximum 200 degrees F.
    f. Provide steel coupling nuts and bolts complying with ASTM A183.
4. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

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C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.

1. Where grooved joints are used in piping, provide grooved valve/equipment connections if available; if not available, provide flanged ends and grooved flange adapters.

D. Valves: Provide valves where indicated:

1. Provide drain valves where indicated, and if not indicated, provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 1 inch gate valves with cap; pipe to nearest floor drain.

2. Isolate equipment using butterfly valves with lug end flanges or grooved mechanical couplings.

3. For throttling, bypass, or manual flow control services, use globe valves.

4. For throttling and isolation service in chilled and condenser water systems, use only butterfly valves.

5. For shut-off and to isolate parts of systems or vertical risers, use gate, ball, or butterfly valves.

E. Welding Materials and Procedures: Comply with ASME BPVC-IX.

2.2 HEATING WATER AND GLYCOL PIPING, BURIED

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, with AWWA C105/A21.5 polyethylene jacket, or double layer, half-lapped polyethylene tape.

1. Fittings: ASTM A234/A234M, wrought steel welding type with double layer, half-lapped polyethylene tape.

2. Joints: Welded in accordance with AWS D10.12M/D10.12.

3. Casing: Closed glass cell insulation.

B. Copper Tube: ASTM B88 (ASTM B88M), Type L, drawn temper.

1. Fittings: ASME B16.22, wrought copper.

2. Mechanical Press Sealed Fittings: ASME B16.51 or IAPMO/ANSI/CAN Z1117, ICC (IMC), and IAPMO (UMC) approved, with EPDM seals.

a. Manufacturers:

1) FNW; Copper Press: www.fnw.com/#sle.

2) Mueller Streamline, Co; PRS: www.muellerstreamline.com/#sle.

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3) NIBCO INC; Press System: www.nibco.com/#sle.

3. Joints: Braze, AWS A5.8M/A5.8 BCuP copper/silver alloy.
4. Casing: Closed glass cell insulation.

C. Cross-Linked Polyethylene (PEX) Pipe: ASTM F876 or ASTM F877. (ONLY ALLOWED FOR SNOW MELT SYSTEM)

1. Manufacturers:
   a. Uponor, Inc; Wirsbo hePEX: www.uponorpro.com/#sle.
2. Oxygen Barrier: Limit oxygen diffusion through the tube to maximum 0.000044 grains per cu ft/day at 104 degrees F in accordance with DIN 4726.
3. PPI TR-4, Pressure Design Basis:
   a. 160 psig at maximum 73 degrees F.
4. Fittings: Brass and copper.
5. Joints: Mechanical compression fittings.

2.3 HEATING WATER AND GLYCOL PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:

1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D10.12M/D10.12 welded.
2. Threaded Joints: ASME B16.3, malleable iron fittings.
3. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.
4. Mechanical Press Sealed Fittings: ASTM F3226/F3226M, ICC (IMC), and IAPMO (UMC) approved, with EPDM seals.
   a. Manufacturers:
      1) Mueller Streamline, Co; STL: www.muellerstreamline.com/#sle.
      2) NIBCO INC; Bench Press: www.nibco.com/#sle.

B. Copper Tube: ASTM B88 (ASTM B88M), Type L, drawn temper, using one of the following joint types:

1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
   a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

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b. Braze: AWS A5.8M/A5.8 BCuP copper/silver alloy.

2. Grooved Joints: AWWA C606 grooved tube, fittings of same material, and copper-tube-dimension mechanical couplings.

3. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.

4. Mechanical Press Sealed Fittings: ASME B16.51 or IAPMO/ANSI/CAN Z1117, ICC (IMC), and IAPMO (UMC) approved, with EPDM seals.

a. Manufacturers:

1) Apollo Valves; _____: www.apollovalves.com/#sle.

2) FNW; Copper Press: www.fnw.com/#sle.

3) Mueller Streamline, Co; PRS: www.muellerstreamline.com/#sle.

4) NIBCO INC; Press System: www.nibco.com/#sle.

2.4 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn; using one of the following joint types:

1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

2. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

2.5 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe of 2 Inches and Less:

1. Ferrous Piping: 150 psi brass or malleable iron, threaded.

2. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe 2 Inches and Greater:

1. Ferrous Piping: 150 psig forged steel, slip-on.

2. Copper Piping: Bronze.

3. Gaskets: 1/16 inch thick, preformed neoprene.

C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.

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1. Dimensions and Testing: In accordance with AWWA C606.
2. Mechanical Couplings: Comply with ASTM F1476.
3. Housing Material: Ductile iron, galvanized complying with ASTM A536.
4. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
5. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
6. When pipe is field grooved, provide coupling manufacturer's grooving tools.
7. Manufacturers:
    a. Anvil International; _____: www.anvilintl.com/#sle.
    b. Apollo Valves; _____: www.apollovalves.com/#sle.
    c. Shurjoint Piping Products, Inc; _____: www.shurjoint.com/#sle.
    d. Victaulic Company; _____: www.victaulic.com/#sle.

D. Dielectric Connections:

1. Flanges:
    a. Dielectric flanges with same pressure ratings as standard flanges.
    b. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
    c. Dry insulation barrier able to withstand 600-volt breakdown test.
    d. Construct of galvanized steel with threaded end connections to match connecting piping.
    e. Suitable for the required operating pressures and temperatures.
2. Unions:
    a. 1/2 to 1 Inches: Brass solder to galvanized FPT.
    b. 1/2 to 2 Inches: Brass solder to galvanized FPT.
    c. 1/2 to 1 Inches: Brass to galvanized FPT or FIP (Female Iron Pipe).
    d. 3/4 to 1/2 Inch Reducer: Brass solder to galvanized FPT.
    e. Service: 250 psi, minus 20 to 180 deg F.

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PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare piping connections to equipment using jointing system specified.

E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

F. After completion, fill, clean, and treat systems. See Section 23 25 00 for additional requirements.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install heating water, glycol, chilled water, condenser water, and engine exhaust piping to ASME B31.9 requirements.

C. Route piping in orderly manner, parallel to building structure, and maintain gradient.

D. Install piping to conserve building space and to avoid interference with use of space.

E. Group piping whenever practical at common elevations.

F. Sleeve pipe passing through partitions, walls, and floors.

G. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified.

H. Slope piping and arrange to drain at low points.

I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. See Section 23 05 16.

1. Use flexible couplings in expansion loops.

J. Grooved Joints:

1. Install in accordance with the manufacturer's latest published installation instructions.
2. Gaskets to be suitable for the intended service, molded, and produced by the coupling manufacturer.

K. Pipe Hangers and Supports:

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1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.
2. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
3. Place hangers within 12 inches of each horizontal elbow.
4. Use hangers with 1-1/2 inches minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
5. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
7. Provide copper plated hangers and supports for copper piping.

L. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. See Section 23 07 19.

M. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 31 00 .

N. Use eccentric reducers to maintain top of pipe level.

O. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welds.

P. Install valves with stems upright or horizontal, not inverted.

3.3 SCHEDULES

A. Hanger Spacing for Copper Tubing.

1. 1/2 Inch and 3/4 inch: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. 1 Inch: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. 1-1/2 Inches and 2 Inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
4. 2-1/2 Inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
5. 3 Inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
6. 4 Inches: Maximum span, 12 feet; minimum rod size, 1/2 inch.
7. 6 Inches: Maximum span, 14 feet; minimum rod size, 1/2 inch.

B. Hanger Spacing for Steel Piping.

1. 1/2 Inch, 3/4 Inch, and 1 Inch: Maximum span, 7 feet; minimum rod size, 1/4 inch.

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2. 1-1/4 Inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
3. 1-1/2 Inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
4. 2 Inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
5. 2-1/2 Inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
6. 3 Inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
7. 4 Inches: Maximum span, 14 feet; minimum rod size, 1/2 inch.
8. 6 Inches: Maximum span, 17 feet; minimum rod size, 1/2 inch.

END OF SECTION 23 21 13

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SECTION 23 21 14 - HYDRONIC SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Expansion tanks.

B. Air vents.

C. Air separators.

D. Strainers.

E. Pump connectors.

F. Pressure-temperature test plugs.

G. Balancing valves.

H. Relief valves.

I. Glycol system.

1.2 RELATED REQUIREMENTS

A. Section 22 11 19 - Domestic Water Piping Specialties: Backflow preventers.

B. Section 23 21 13 - Hydronic Piping.

C. Section 23 25 00 - HVAC Water Treatment: Pipe cleaning.

1.3 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.

C. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard; 2025.

D. ASME B16.11 - Forged Fittings, Socket-Welding and Threaded; 2021.

E. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2025, with Errata .

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F. AWWA D121 - Bolted Aboveground Thermosetting Fiberglass-Reinforced Plastic Panel-Type Tanks for Water Storage; 2024.

1.4 ADMINISTRATIVE REQUIREMENTS

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

B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description and model.

C. Shop Drawings: Provide for field-erected water tanks.

1. Provide signed and sealed shop drawings and structural analysis by manufacturer's qualified professional engineer.
2. Provide plans and elevations showing equipment assembly, including fabrication and installation details. Show location and sizes of connections.
3. Indicate safety ladders, railings, and service platforms.
4. Indicate clearances required for service, access, maintenance, and replacement of internal components.

D. Certificates: Inspection certificates for pressure vessels from authority having jurisdiction.

E. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

F. Project Record Documents: Record actual locations of flow controls.

G. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.6 QUALITY ASSURANCE

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

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1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1 EXPANSION TANKS

A. Manufacturers:

1. American Wheatley, a company of Global Flow Products, LLC: www.wheatleyhvac.com/#sle.
2. Amtrol Inc: www.amtrol.com/#sle.
3. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.

B. Maximum Rated Working Pressure: 150 psi.

C. Maximum Allowable Service Temperature: 240 degrees F.

D. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, adjustable flexible EPDM diaphragm or bladder seal factory precharged to 12 psi, and steel support stand.

E. Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced-pressure-principle backflow preventer, test cocks, strainer, vacuum breaker, and valved by-pass.

1. See Section 22 11 19 for backflow preventer specifications.

F. Accessories: Provide air-charging fitting, bulls eye sight glass, pressure gauge, and tank drain ball valve.

2.2 AIR VENTS

A. Manufacturers:

1. Armstrong International, Inc: www.armstronginternational.com/#sle.
2. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.

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3. Flamco: www.flamcogroup.us/#sle.

B. Manual Air Vent: Short vertical sections of 2-inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

C. Float Air Vent:

1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

D. Maximum Fluid Pressure: 150 psi.

E. Maximum Fluid Temperature: 250 degrees F.

2.3 AIR SEPARATORS

A. Coalescing Air/Dirt Separators:

1. Manufacturers:

a. American Wheatley, a company of Global Flow Products, LLC: www.wheatleyhvac.com/#sle.

b. Armstrong International, Inc: www.armstronginternational.com/#sle.

c. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.

d. Flamco: www.flamcogroup.us/#sle.

e. Spirotherm, Inc: www.spirotherm.com/#sle.

2. Tank: Fabricated steel tank; tested and stamped in accordance with ASME BPVC-VIII-1 for maximum fluid service subject to application requirements and manufacturer's standard maximum operating conditions.

3. Coalescing Medium: Provide structured copper or stainless steel medium filling the entire vessel to suppress turbulence and provide air elimination efficiency of 100 percent free air, 100 percent entrained air, and 99.6 percent dissolved air at the installed location.

4. Air Vent: Integral float actuated air vent at top fitting of tank rated at 150 psi, threaded to top of separator.

5. End Connections: Class 150 flanged for 2-1/2 inch and larger otherwise threaded.

6. Blowdown Connection: Threaded.

7. Size: Match system flow capacity.

8. Maximum Fluid Service Pressure: 150 psi.

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9. Maximum Fluid Service Temperature: 250 degrees F.

2.4 STRAINERS

A. Manufacturers:

1. American Wheatley, a company of Global Flow Products, LLC: www.wheatleyhvac.com/#sle.
2. Armstrong International, Inc: www.armstronginternational.com/#sle.
3. Flexicraft Industries: www.flexicraft.com/#sle.
4. Nexus Valve, Inc: www.nexusvalve.com/#sle.
5. The Metraflex Company; LPD Y Strainer: www.metraflex.com/#sle.

B. Size 2 inch and Under:

1. Provide threaded, grooved, or sweat brass or iron body for up to 175 psi working pressure, Y-pattern strainer with 1/32 inch stainless steel perforated screen.
2. Body Material by Fluid Service:
   a. Cast Iron or Brass:
      1) Steam: Up to 250 psi at 450 degrees F.
      2) Liquids: Up to 400 psi at 150 degrees F.

C. Size 2-1/2 inch to 4 inch:

1. Provide flanged or grooved iron body for up to 175 psi working pressure, up to 250 degrees F working temperature, Y-pattern strainer with 1/16 inch or 3/64 inch stainless steel perforated screen.
2. Body Material by Fluid Service:
   a. Cast Iron:
      1) Steam: Up to 125 psi at 350 degrees F.
      2) Liquids: Up to 200 psi at 150 degrees F.

2.5 PUMP CONNECTORS

A. Manufacturers:

1. American Wheatley, a company of Global Flow Products, LLC: www.wheatleyhvac.com/#sle.
2. Anvil International; AnviFlex: www.anvilintl.com/#sle.

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3. FNW: www.fnw.com/#sle.
4. The Metraflex Company; Vane Flex: www.metraflex.com/#sle.

B. Flexible Connectors: Flanged, EPDM rubber double-sphere type with wetted components of stainless steel, sized to match piping.
1. Maximum Operating Service: 150 psi at 120 degrees F.
2. Accommodate the Following:
a. Axial Deflection in Compression and Expansion: 2 inch.
b. Lateral Movement: 2 inch.
c. Angular Rotation: 15 degrees.
d. Force developed by 1.5 times specified maximum allowable operating pressure.
3. End Connections: Same as specified for pipe jointing.
4. Provide pump connector with integral vanes to reduce turbulent flow.
5. Provide necessary accessories including, but not limited to, swivel joints.

2.6 PRESSURE-TEMPERATURE TEST PLUGS

A. Manufacturers:
1. FNW: www.fnw.com/#sle.
2. Peterson Equipment Company Inc: www.petesplug.com/#sle.
3. Sisco Manufacturing Company Inc: www.siscomfg.com/#sle.

B. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and Neoprene rated for minimum 200 degrees F.

C. Application: Use extended length plugs to clear insulated piping.

2.7 RELIEF VALVES

A. Manufacturers:
1. American Wheatley, a company of Global Flow Products, LLC: www.wheatleyhvac.com/#sle.
2. Apollo Valves: www.apollovalves.com/#sle.
3. Armstrong International, Inc: www.armstronginternational.com/#sle.
4. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.

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B. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.8 GLYCOL SYSTEM

A. Pump System:

1. Storage: 15 gal polypropylene tank with bolt-removable hinged solid cover and enamel coated carbon steel tank-stand.
2. Pump:
    a. Thermally protected 1/4 hp motor at 115 to 120 VAC, single phase rated for indoor service.
    b. Maximum Service Operation: 100 psi at 85 degrees F.
3. Mixer: Tank-stand mounted, removable motorized mixer, prewired and controlled from control panel interface.
4. Mechanical Accessories: System isolation valves, strainer, and pressure gauges.
5. Control Panel:
    a. Fused single-point system connection rated at 115 to 120 VAC, single phase.
    b. Interface: Hand switches with indicating lights for ON, FAULT, and LOW LEVEL.
    c. Pressure Switch: Panel-mounted and prewired for 10 psi cut-in and 40 psi cut-out, adjustable.
    d. Low Level Cut-Off Switch: Prewired to shut-down unit upon activation. Tank-side mounted.
    e. High Level Cut-Off Float Switch: Prewired to shut-down unit upon activation. Tank-side mounted.
    f. Auxiliary Dry Contacts: Low level, high level, and fault/alarm for remote monitoring.
    g. Alarm: Audio-visual device with panel-mounted silencing switch to activate upon system fault or alarm with audio pressure level rated for 90 dB.
6. Pressure Relief Valve: System-mounted brass valve tubed from pump discharge side into tank with adjustable setpoint between 20 psi and 150 psi.
7. Expansion Tank: Diaphragm type with vent fitting with air separator, and automatic air vent.

B. Glycol Solution:

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1. Water-based solution mix containing 40 percent propylene glycol by volume required for cooling or heating system operating temperature range.
2. Cooling or heating System Operating Temperature Range: Between freezing and boiling points of 3 and 220 degees F at 14.7 psia.

PART 3 EXECUTION

3.1 EXAMINATION

A. Field-Erected Water Tanks:

1. Verify anchoring slabs, foundations, and structures ready to receive equipment.
2. Verify tank components free from damage and corrosion.
3. Verify pipe connection flanges are completely clean without signs of damage or degradation.

3.2 INSTALLATION

A. Install specialties and equipment in accordance with manufacturer's instructions.

B. Where large air quantities can accumulate, provide enlarged air collection standpipes.

C. Provide manual air vents at system high points and as indicated.

D. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

E. Provide air separator on suction side of system circulation pump and connect to expansion tank.

F. Provide valved drain and hose connection on strainer blowdown connection.

G. Provide pump suction fitting on suction side of base-mounted centrifugal pumps. Remove temporary strainers after cleaning systems.

H. Support pump fittings with floor-mounted pipe and flange supports.

I. Provide radiator valves on water inlet to terminal heating units such as radiation, unit heaters, and fan coil units.

J. Provide radiator balancing valves on water outlet from terminal heating units such as radiation, unit heaters, and fan coil units.

K. Provide relief valves on pressure tanks, low-pressure side of reducing valves, heat exchangers, and expansion tanks.

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L. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

M. Pipe relief valve outlet to nearest floor drain.

N. Where one line vents several relief valves, make cross-sectional area equal to sum of individual vent areas.

O. Clean and flush glycol system before adding glycol solution, see Section 23 25 00.

P. Feed glycol solution to system through make-up line with pressure regulator, venting system high points.

Q. Feed glycol solution to system through make-up line with pressure regulator, venting system high points. Set to fill at 12 psi.

R. Feed glycol solution to system through make-up line with pressure regulator, venting system high points. Pressure system cold at 5 psi.

S. Perform tests determining strength of glycol and water solution and submit written test results.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Field-Erected Water Storage Tanks:

1. Perform leakage test in accordance with tank manufacturer's instructions.

3.4 CLEANING

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

B. Clean interior of water tanks in accordance with manufacturer's instructions.

3.5 MAINTENANCE

A. See Section 01 70 00 - Execution Requirements for additional requirements relating to maintenance service.

B. Provide service and maintenance of glycol system for one year from date of Substantial Completion at no extra charge to CPL.

C. Perform monthly visit to make glycol fluid concentration analysis on site with refractive index measurement instrument. Report findings in detail in writing, including analysis and amounts of glycol or water added.

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D. Explain corrective actions to CPL's maintenance personnel in person.

END OF SECTION 23 21 14

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SECTION 23 21 23 - HYDRONIC PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. In-line pumps.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 23 05 48 - Vibration and Seismic Controls for HVAC.

C. Section 23 07 16 - HVAC Equipment Insulation.

D. Section 23 07 19 - HVAC Piping Insulation.

E. Section 23 09 23 - Direct-Digital Control System for HVAC.

F. Section 23 09 34 - Variable-Frequency Motor Controllers for HVAC.

G. Section 23 21 13 - Hydronic Piping.

H. Section 23 21 14 - Hydronic Specialties.

I. Section 25 35 00 - Integrated Automation Instrumentation and Terminal Devices for HVAC.

J. Section 26 05 83 - Wiring Connections.

1.3 REFERENCE STANDARDS

A. ASHRAE Std 135 - BACnet - A Data Communication Protocol for Building Automation and Control Networks; 2024, with Errata (2025).

B. Bluetooth CS - Bluetooth Core Specification; 2016, Addendum 2017.

C. IEEE 802.11 - IEEE Standard for Information Technology--Telecommunications and Information Exchange between Systems Local and Metropolitan Area Networks--Specific Requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications; 2024, with Amendment (2025).

D. IEEE 802.15.4 - IEEE Standard for Low-Rate Wireless Networks; 2024.

E. LonMark Interoperability Guide - LonMark Application-Layer Interoperability Guide and LonMark Layer 1-6 Interoperability Guide; Version 3.4; 2005.

F. Modbus (PS) - The Modbus Organization Communications Protocol.; Latest Update.

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G. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

H. NEMA MG 00001 - Motors and Generators; 2024.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

C. Millwright's Certificate: Certify that base mounted pumps have been aligned.

D. Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.

E. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

F. Maintenance Materials: Furnish the following for CPL's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.

2. Extra Pump Seals: One set for each type and size of pump.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of pumps, with minimum three years of documented experience.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Armstrong Fluid Technology, Inc; _____: www.armstrongfluidtechnology.com/#sle.

B. Bell & Gossett, a Xylem Inc. brand; _____: www.bellgossett.com/#sle.

C. Grundfos Pumps Corporation; _____: www.grundfos.com/#sle.

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2.2 GENERAL

A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

B. Minimum Quality Standard: UL 778.

C. Electrical Requirements:

1. Listed and classified by UL or testing agency acceptable to authority having jurisdiction as suitable for the purpose specified and indicated.

2. Variable Frequency Drives (VFDs): Provide in accordance with Section 23 09 34, except for integral-VFDs.

3. Enclosures: Provide unspecified product(s) required to fit motor:

2.3 IN-LINE PUMPS

A. Split-Coupled, Multi-Stage: Vertical pump with radially-split casing, integral controls, bottom mount suction, and discharge pipe connections with gauge ports rated for discharge pressures up to 580 psi.

B. Casing: Cast iron with seal flush connection, threaded suction, and discharge ports with gauge port and drain plug.

C. Impeller: Bronze, fully enclosed, keyed directly to motor shaft or extension.

D. Shaft: Carbon steel with stainless steel impeller cap screw or nut and bronze sleeve.

E. Seal: Mechanical seal, 225 degrees F maximum continuous duty temperature.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.

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C. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close-coupled or base-mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4 inches and over.

D. Provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve and balancing valve on pump discharge.

E. Provide air cock and drain connection on horizontal pump casings.

F. Provide drains for bases and seals, piped to and discharging into floor drains.

G. Install close-coupled and base-mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place. See Section 03 30 00.

H. Provide side-stream filtration system for closed loop systems. Install across pump with flow from pump discharge to pump suction from pump tappings.

I. Controls Human-Machine Interface (HMI): HVAC operator terminal; see Section 25 35 00.

END OF SECTION 23 21 23

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SECTION 23 23 00 - REFRIGERANT PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping.

B. Refrigerant.

1.2 RELATED REQUIREMENTS

A. Section 08 31 00 - Access Doors and Panels.

B. Section 23 07 16 - HVAC Equipment Insulation.

C. Section 23 07 19 - HVAC Piping Insulation.

D. Section 23 09 93 - Sequence of Operations for HVAC Controls.

E. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. AHRI 730 (I-P) - Flow Capacity Rating of Suction Line Filters and Suction Line Filter Driers; 2013 (Reapproved 2014).

B. AHRI 760 (I-P) - Performance Rating of Solenoid Valves for Use with Volatile Refrigerants; 2014.

C. AHRI 761 (SI) - Performance Rating of Solenoid Valves for Use with Volatile Refrigerants; 2014.

D. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2024, with Addendum (2025).

E. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants; 2024, with Addendum (2025).

F. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2025, with Errata .

G. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2025, with Errata.

H. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

I. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2024.

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J. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2022.

K. ASME B31.9 - Building Services Piping; 2025.

L. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.

M. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

N. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2025.

O. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

P. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

Q. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2023.

R. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

S. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

T. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

U. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

V. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

W. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 2024.

X. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

Y. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013 (Reapproved 2021).

Z. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.

AA. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Errata (2026).

BB. IAPMO (UMC) - 2024 Uniform Mechanical Code; 2024.

CC. ICC (IMC) - International Mechanical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

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DD. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2025.

EE. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

FF. UL 429 - Electrically Operated Valves; Current Edition, Including All Revisions.

GG. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

C. Shop Drawings: Indicate schematic layout of system, including equipment, critical dimensions, and sizes.

D. Design Data: Submit design data indicating pipe sizing. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

E. Test Reports: Indicate results of leak test, acid test.

F. Manufacturer's Installation Instructions: Indicate support, connection requirements, and isolation for servicing.

G. Submit welders certification of compliance with ASME BPVC-IX.

H. Project Record Documents: Record exact locations of equipment and refrigeration accessories on record drawings.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum 4 years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

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C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure integrity of system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.

C. Refrigerant Charging (Packed Angle) Valve: Use in liquid line between receiver shut-off valve and expansion valve.

2.2 REGULATORY REQUIREMENTS

A. Comply with ASME B31.9 for installation of piping system.

B. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

C. Welders Certification: In accordance with ASME BPVC-IX.

D. Products Requiring Electrical Connection: Listed and classified by UL, as suitable for the purpose indicated.

2.3 PIPING

A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.

1. Fittings: ASME B16.22 wrought copper.
2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.
3. Mechanical Press Fittings: UL 207 listed, ICC (IMC) and IAPMO (UMC) approved, with HNBR seals.

B. Copper Tube to 7/8-inch OD: ASTM B88 (ASTM B88M), Type K (A), annealed.

1. Fittings: ASME B16.26 cast copper.
2. Joints: Flared.

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3. Mechanical Press Sealed Fittings: UL 207 listed, ICC (IMC) and IAPMO (UMC) approved, with HNBR seals.

C. Preinsulated Refrigerant Piping Linesets:

1. Copper Tube: ASTM B280 seamless, anticorrosion pipe; lineset is precoupled to include two joined pipes.

2. Insulation: Polyethelene closed-cell foam; preapplied to entire length of lineset. Weather- and UV-resistant for outdoor installation. Maximum flame spread index of 25 and maximum smoke developed index of 50, when tested in accordance with ASTM E84 or UL 723.

2.4 REFRIGERANT

A. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) no greater than that allowed by federal code.

B. Refrigerant: R-454B as defined in ASHRAE Std 34.

2.5 MOISTURE AND LIQUID INDICATORS

A. Manufacturers:

1. Henry Technologies: www.henrytech.com/#sle.

2. Mueller Refrigeration: www.muellerrefrigeration.com/#sle.

3. Parker Hannifin - Sporlan Division; See-All: www.parker.com/#sle.

B. Indicators: Single port type, UL listed, with copper or brass body, flared or soldered ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

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3.2 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.5.
2. Support horizontal piping as indicated.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
6. Provide copper plated hangers and supports for copper piping.

G. Provide clearance for installation of insulation and access to valves and fittings.

H. Provide access to concealed valves and fittings. Coordinate size and location of access doors with Section 08 31 00.

I. Flood piping system with nitrogen when brazing.

J. Insulate piping.

K. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

L. Fully charge completed system with refrigerant after testing.

M. Provide electrical connection to solenoid valves. See Section 26 05 83.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Test refrigeration system in accordance with ASME B31.5.

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C. Pressure test system with dry nitrogen to 200 psi. Perform final tests at 27 inches vacuum and 200 psi using halide torch. Test to no leakage.

END OF SECTION 23 23 00

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SECTION 23 25 00 - HVAC WATER TREATMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials.

1. System cleaner.
2. Closed system treatment (water).

B. By-pass (pot) feeder.

C. Glycol.

1.2 RELATED REQUIREMENTS

A. Section 01 60 00 - Product Requirements: CPL furnished treatment equipment.

1.3 REFERENCE STANDARDS

A. UL (DIR) - Online Certifications Directory; Current Edition.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.

C. Operation and Maintenance Data: Include data on chemical feed pumps, agitators, and other equipment including spare parts lists, procedures, and treatment programs. Include step by step instructions on test procedures including target concentrations.

D. Maintenance Materials: Furnish the following for CPL's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.5 QUALITY ASSURANCE

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

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shall have local representatives with water analysis laboratories and full time service personnel.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum 3 years of experience and approved by manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. AmSolv-Amrep, Inc: www.amsolv.com/#sle.

B. GE Water & Process Technologies: www.gewater.com/#sle.

C. Nalco, an Ecolab Company: www.nalco.com/#sle.

2.2 REGULATORY REQUIREMENTS

A. Comply with applicable codes for addition of non-potable chemicals to building mechanical systems and to public sewage systems.

B. Comply with UL (DIR) requirements.

C. Perform work in accordance with local health department regulations.

D. Provide certificate of compliance from Authority Having Jurisdiction indicating approval of installation.

2.3 MATERIALS

A. System Cleaner:

1. Manufacturers:
    a. AmSolv-Amrep, Inc: www.amsolv.com/#sle.
    b. GE Water & Process Technologies: www.gewater.com/#sle.
    c. Nalco, an Ecolab Company: www.nalco.com/#sle.
2. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodiumtripoly phosphate and sodium molybdate.
3. Biocide chlorine release agents such as sodium hypochlorite or calcium hypochlorite or microbiocides such as quarternary ammonia compounds, tributyltin oxide, methylene bis (thiocyanate).

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B. Closed System Treatment (Water):

1. Manufacturers:

a. AmSolv-Amrep, Inc: www.amsolv.com/#sle.

b. GE Water & Process Technologies: www.gewater.com/#sle.

c. Nalco, an Ecolab Company: www.nalco.com/#sle.

2. Sequestering agent to reduce deposits and adjust pH; polyphosphate.

3. Corrosion inhibitors; boron-nitrite, sodium nitrite and borax, sodium totyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.

4. Conductivity enhancers; phosphates or phosphonates.

2.4 BY-PASS (POT) FEEDER

A. Manufacturers:

1. Griswold Controls: www.griswoldcontrols.com/#sle.

2. J. L. Wingert Company: www.jlwingert.com/#sle.

3. Neptune, a brand of the Dover Company: www.neptune1.com/#sle.

2.5 GLYCOL

A. Description: Glycol-based anti-freeze protection for heat-transfer fluid in hydronic systems; corrosion inhibitors added for prevention of metal piping deterioration.

B. Application: For hydronic heating and cooling or geothermal system.

C. Composition: Use nontoxic propylene glycol.

1. Mixture: 40 by volume mixed into water.

D. Operating Temperature: Rated for operating range of hydronic system.

1. Minimum Mixture Operating Temperature: 0 degrees F.

2. Maximum Mixture Operating Temperature: 215 degrees F.

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PART 3 EXECUTION

3.1 PREPARATION

A. Systems shall be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.

B. Place terminal control valves in open position during cleaning.

C. Verify that electric power is available and of the correct characteristics.

3.2 CLEANING SEQUENCE

A. Concentration:

1. As recommended by manufacturer.

B. Hot Water Heating Systems:

1. Apply heat while circulating, slowly raising temperature to 160 degrees F and maintain for 12 hours minimum.

2. Remove heat and circulate to 100 degrees F or less; drain systems as quickly as possible and refill with clean water.

3. Circulate for 6 hours at design temperatures, then drain.

4. Refill with clean water and repeat until system cleaner is removed.

C. Use neutralizer agents on recommendation of system cleaner supplier and approval of Engineer.

D. Flush open systems and glycol filled closed systems with clean water for one hour minimum. Drain completely and refill.

E. Remove, clean, and replace strainer screens.

F. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

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3.4 CLOSED SYSTEM TREATMENT

A. Provide one bypass feeder on each system. Install isolating and drain valves and necessary piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.

B. Introduce closed system treatment through bypass feeder when required or indicated by test.

C. Provide 3/4 inch water coupon rack around circulating pumps with space for 4 test specimens.

3.5 CLOSEOUT ACTIVITIES

A. Training: Train CPL's personnel on operation and maintenance of chemical treatment system.

1. Provide minimum of two hours of instruction for two people.
2. Have operation and maintenance data prepared and available for review during training.
3. Conduct training using actual equipment after treated system has been put into full operation.

3.6 MAINTENANCE

A. Perform maintenance work using competent and qualified personnel under the supervision and in the direct employ of the equipment manufacturer or original installer.

B. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of CPL.

C. Provide service and maintenance of treatment systems for one year from Date of Substantial Completion.

D. Provide monthly technical service visits to perform field inspections and make water analysis on-site. Detail findings in writing on proper practices, chemical treating requirements, and corrective actions needed. Submit two copies of field service report after each visit.

E. Provide laboratory and technical assistance services during this maintenance period.

F. Provide on-site inspections of equipment during scheduled or emergency shutdown to properly evaluate success of water treatment program, and make recommendations in writing based upon these inspections.

END OF SECTION 23 25 00

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SECTION 23 31 00 - HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal ducts.

B. Flexible ducts.

1.2 RELATED REQUIREMENTS

A. Section 23 01 30.51 - HVAC Air-Distribution System Cleaning: Post install duct cleaning.

B. Section 23 05 48 - Vibration and Seismic Controls for HVAC.

C. Section 23 07 13 - Duct Insulation: External insulation and duct liner.

D. Section 23 33 00 - Air Duct Accessories.

E. Section 23 36 00 - Air Terminal Units.

F. Section 23 37 00 - Air Outlets and Inlets: Fabric air distribution devices.

1.3 REFERENCE STANDARDS

A. ANSI Z9.5 - Laboratory Ventilation; 2022.

B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASHRAE Std 90.1 I-P-2019 - Energy Standard for Buildings Except Low-Rise Residential Buildings; 2019, with Errata and Addenda (2021).

E. ASHRAE Std 126 - Method of Testing HVAC Air Ducts; 2020.

F. ASME AG-1 - Code on Nuclear Air and Gas Treatment; 2019.

G. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

H. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2025a.

I. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2025.

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J. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; 2025b.

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 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; 2025.

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

P. ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe; 2020 (Reapproved 2025).

Q. ASTM C14M - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe (Metric); 2020 (Reapproved 2025).

R. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

S. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets; 2021.

T. ASTM C443M - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric); 2021.

U. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

V. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

W. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

X. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2026.

Y. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.

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Z. ASTM E2336 - Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems; 2025.

AA. ICC (IMC) - International Mechanical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

BB. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2018, with Editorial Revision (2020).

CC. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry; 2018, with Editorial Revision (2020).

DD. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2017, with Editorial Revision (2020).

EE. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2023.

FF. ISO 6944-1 - Fire Containment -- Elements of Building Construction -- Part 1: Ventilation Ducts; 2024.

GG. NFPA 45 - Standard on Fire Protection for Laboratories Using Chemicals; 2019.

HH. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

II. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

JJ. NFPA 91 - Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids; 2026.

KK. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

LL. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

MM. SMACNA (FGD) - Fibrous Glass Duct Construction Standards; 2021.

NN. SMACNA (FRP) - Thermoset FRP Duct Construction Manual; 2016.

OO. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines; 2001.

PP. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; 2012.

QQ. SMACNA (Phenolic) - Phenolic Duct Construction Standards; 2015.

RR. SMACNA (PVC) - Thermoplastic Duct (PVC) Construction Manual; 1995.

SS. SMACNA (RIDC) - Rectangular Industrial Duct Construction Standards; 2024.

TT. SMACNA (ROUND) - Round Industrial Duct Construction Standards; 2013.

UU. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2024.

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VV. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

WW. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

XX. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.

YY. UL 1978 - Grease Ducts; Current Edition, Including All Revisions.

ZZ. UL 2221 - Tests of Fire Resistive Grease Duct Enclosure Assemblies; Current Edition, Including All Revisions.

AAA. UL 2518 - Standard for Safety Air Dispersion Systems; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for duct materials.

C. Shop Drawings: Indicate duct fitting types, gauges, sizes, welds, and configuration.

D. Manufacturer's Certificate: Certify that installation of glass fiber ductwork meets or exceed specified requirements.

E. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate per appropriate seal class, following SMACNA (LEAK).

F. Manufacturer's Installation Instructions: Indicate special procedures for glass fiber ducts.

G. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

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1.6 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

1.7 WARRANTY

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

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.

B. Provide metal duct unless otherwise indicated. Fibrous glass duct can be substituted at the Contractor's option.

C. Acoustical Treatment: Provide sound-absorbing liners and sectional silencers for metal-based ducts in compliance with Section 23 33 19.

D. Duct Shape and Material in accordance with Allowed Static Pressure Range:

1. Round: Plus or minus 4 in-wc of galvanized steel.
2. Rectangular: Plus or minus 3 in-wc of galvanized steel.

E. Duct Sealing and Leakage in accordance with Static Pressure Class:

1. Duct Pressure Class and Material for Common Mechanical Ventilation Applications:
    a. Supply Air: 3 in-wc pressure class, galvanized steel.
    b. Outside Air Intake: 3 in-wc pressure class, galvanized steel.
    c. Return and Relief Air: 3 in-wc pressure class, galvanized steel.
    d. General Exhaust Air: 3 in-wc pressure class, galvanized steel.
    e. Transfer-air and Sound Booths: 3 in-wc pressure class, galvanized steel.
2. Low Pressure Service: Up to 2 in-wc:
    a. Seal: Class C, apply to seal off transverse joints.
    b. Leakage:

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1) Rectangular: Class 24 or 24 cfm/100 sq ft.

2) Round: Class 12 or 12 cfm/100 sq ft.

3. Low Pressure Service: From 2 in-wc to 3 in-wc:

a. Seal: Class B, apply sealing of transverse joints and longitudinal seams.

b. Leakage:

1) Rectangular: Class 12 or 12 cfm/100 sq ft.

2) Round: Class 6 or 6 cfm/100 sq ft.

4. Medium and High Pressure Service: Above 3 in-wc:

a. Seal: Class A, apply sealing of transverse joints, longitudinal seams, and duct wall penetrations.

b. Leakage:

1) Rectangular: Class 6 or 6 cfm/100 sq ft.

2) Round: Class 3 or 3 cfm/100 sq ft.

F. Duct Fabrication Requirements:

1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.

2. No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE (FUND) Handbook - Fundamentals.

3. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.

4. Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide airfoil turning vanes of perforated metal with glass fiber insulation.

5. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.

6. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

7. Provide turning vanes of perforated metal with glass fiber insulation when an acoustical lining is required.

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8. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.2 METAL DUCTS

A. Material Requirements:

1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Rectangular Metal Duct:

1. Rectangular Single Wall: Rectangular, longitudinal lock seam duct with galvanized steel wall.

2. Rectangular Double Wall Insulated: Rectangular, longitudinal lock seam duct with galvanized steel outer wall, perforated galvanized steel inner wall; fitting with solid inner wall.

a. Insulation:

1) Thickness: 2 inch.

2) Material: Duct Lining (see duct insulation specification).

C. Round Metal Ducts:

1. Round Single Wall Duct: Round lock seam duct with galvanized steel outer wall.

a. Manufacturers:

1) EHG, a DMI Company: www.ehgduct.com/#sle.

2) Elgen Manufacturing Company, Inc; Snap Lock Pipes and Fittings: www.elgenmfg.com/#sle.

3) Linx Industries, Inc, a DMI Company: www.li-hvac.com/#sle.

4) MKT Metal Manufacturing: www.mktduct.com/#sle.

5) Nordfab Ducting: www.nordfab.com/#sle.

2. Round Double Wall Insulated Duct: Round spiral lock seam duct with galvanized steel outer wall, perforated galvanized steel inner wall; fitting with the solid inner wall.

a. Insulation:

1) Thickness: 1 inch.

2) Material: Air.

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3. Round Connection System: Interlocking duct connection system in accordance with SMACNA (DCS).

D. Round Spiral Duct:

1. Round spiral lock seam duct with galvanized steel outer wall.
2. Manufacturers:
   a. EHG, a DMI Company: www.ehgduct.com/#sle.
   b. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.
   c. GSI, a DMI Company: www.greenseamind.com/#sle.
   d. Linx Industries, Inc, a DMI Company: www.li-hvac.com/#sle.
   e. MKT Metal Manufacturing: www.mktduct.com/#sle.

E. Connectors, Fittings, Sealants, and Miscellaneous:

1. Fittings: Manufacture with solid inner wall of perforated galvanized steel.
2. Transverse Duct Connection System: SMACNA "E" rated rigid class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips in accordance with SMACNA (DCS).
   a. Manufacturers:
      1) Carlisle HVAC Products; Nexus Flange Connectors with Sealant Pocket: www.carlislehvac.com/#sle.
      2) Ductmate Industries, Inc, a DMI Company: www.ductmate.com/#sle.
      3) Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.
      4) MKT Metal Manufacturing: www.mktduct.com/#sle.
3. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
   a. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
   b. VOC Content: Not more than 250 g/L, excluding water.
   c. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
   d. For Use with Flexible Ducts: UL labeled.
   e. Manufacturers:
      1) Carlisle HVAC Products; Hardcast Versa-Grip 181 Water Based Fiber Reinforced Duct Sealant: www.carlislehvac.com/#sle.

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2) Design Polymerics; DP 1010 Water Based Smooth Duct Sealant, Premium Quality: www.designpoly.com/#sle.

3) Ductmate Industries, Inc, a DMI Company: www.ductmate.com/#sle.

4) Elgen Manufacturing Company, Inc; Duct Sealer: www.elgenmfg.com/#sle.

5) H.B. Fuller Construction Products, Inc: www.fosterproducts.com//#sle.

4. Gasket Tape:

a. Provide butyl rubber gasket tape for a flexible seal between transfer duct connector (TDC), transverse duct flange (TDF), applied flange connections, and angle ring connections.

b. Manufacturers:

1) Design Polymerics; DP 1040 100 Percent Solids, High Pressure/High-Velocity Butyl Gasket Tape: www.designpoly.com/#sle.

2.3 FLEXIBLE DUCTS

A. Acoustic Flexible Ducts: UL 181, Class 1, spunbond nylon, mechanically fastened and rolled using galvanized steel to form spiral helix.

1. Insulation: Fiberglass insulation with metallic vapor barrier.

2. Inner Core: Spunbonded, nonwoven inner core.

3. Pressure Rating: 6 in-wc positive and 5 in-wc negative.

4. Maximum Velocity: 4000 fpm.

5. Temperature Range: Minus 20 degrees F to 250 degrees F.

6. Manufacturers:

a. Flexmaster USA, a brand of Masterduct, Inc; Type 6: www.flexmasterusa.com/#sle.

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

PART 3 EXECUTION

3.1 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install products following the manufacturer's instructions.

C. Comply with safety standards NFPA 90A and NFPA 90B.

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D. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

F. Flexible Ducts: Connect to metal ducts with mechanical fastener.

G. Duct sizes indicated are precise inside dimensions. For lined ducts, maintain sizes inside lining.

H. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

I. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with a crimp in the direction of airflow.

J. Use double nuts and lock washers on threaded rod supports.

K. Connect terminal units to supply ducts directly or with one foot maximum length of flexible duct. Do not use flexible duct to change direction.

L. Duct Accessories, Terminal Units, Inlets, and Outlets: Interconnect as indicated in Sections 23 33 00, 23 36 00, and 23 37 00.

M. Duct Insulation: Provide duct insulation. See Section 23 07 13.

END OF SECTION 23 31 00

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SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air turning devices/extractors.

B. Backdraft dampers - metal.

C. Combination fire and smoke dampers.

D. Duct access doors.

E. Duct test holes.

F. Fire dampers.

G. Flexible duct connectors.

H. Smoke dampers.

I. Volume control dampers.

J. Low leakage (Class 1A) control dampers.

K. Miscellaneous Products:

1. Internal strut end plugs.
2. Duct opening closure film.

1.2 RELATED REQUIREMENTS

A. Section 23 05 48 - Vibration and Seismic Controls for HVAC.

B. Section 23 31 00 - HVAC Ducts and Casings.

C. Section 23 36 00 - Air Terminal Units: Pressure regulating damper assemblies.

1.3 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

B. NFPA 92 - Standard for Smoke Control Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

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D. UL 33 - Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.

E. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.

F. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide for shop-fabricated assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.

C. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers.

D. Manufacturer's Installation Instructions: Provide instructions for fire dampers.

E. Project Record Drawings: Record actual locations of access doors and test holes.

F. Maintenance Materials: Furnish the following for CPL's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements for additional provisions.

2. Extra Fusible Links: One of each type and size.

1.5 QUALITY ASSURANCE

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

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.1 AIR TURNING DEVICES/EXTRACTORS

A. Manufacturers:

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1. Carlisle HVAC Products; Dynair Hollow Vane and Rail (Double Wall Vane): www.carlislehvac.com/#sle.
2. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.
3. Krueger-HVAC, Division of Air System Components: www.krueger-hvac.com/#sle.
4. Ruskin Company: www.ruskin.com/#sle.
5. Titus HVAC, a brand of Johnson Controls: www.titus-hvac.com/#sle.

B. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.2 BACKDRAFT DAMPERS - METAL

A. Manufacturers:

1. Louvers & Dampers, Inc, a brand of Mestek, Inc: www.louvers-dampers.com/#sle.
2. Nailor Industries, Inc: www.nailor.com/#sle.
3. Pottorff: www.pottorff.com/#sle.
4. Ruskin Company: www.ruskin.com/#sle.
5. United Enertech: www.unitedenertech.com/#sle.

B. Gravity Backdraft Dampers, Size 18 by 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

2.3 COMBINATION FIRE AND SMOKE DAMPERS

2.4 DUCT ACCESS DOORS

A. Manufacturers:

1. Acudor Products Inc, a Division of Nelson Industrial Inc: www.acudor.com/#sle.
2. Ductmate Industries, Inc, a DMI Company: www.ductmate.com/#sle.
3. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.
4. Lloyd Industries, Inc: www.firedamper.com/#sle.
5. Nailor Industries, Inc: www.nailor.com/#sle.
6. Ruskin Company: www.ruskin.com/#sle.
7. SEMCO LLC: www.semcohvac.com/#sle.

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8. The Williams Brothers Corporation of America: www.wbdoors.com/#sle.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

2.5 DUCT TEST HOLES

A. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.6 FIRE DAMPERS

A. Manufacturers:

1. NCA, a brand of Metal Industries Inc; _____: www.ncamfg.com/#sle.
2. Ruskin Company: www.ruskin.com/#sle.
3. Price.

B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

C. Horizontal Dampers: Galvanized steel, 22-gauge, 0.0299-inch frame, stainless steel closure spring, and lightweight, heat-retardant, non-asbestos fabric blanket.

D. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1-inch pressure-class ducts up to 12 inches in height.

E. Multiple Blade Dampers: 16-gauge, 0.0598-inch galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 by 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

F. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

2.7 FLEXIBLE DUCT CONNECTORS

A. Manufacturers:

1. Carlisle HVAC Products; Dynair Connector Plus G90 Steel Offset Seam Neoprene Fabric: www.carlislehvac.com/#sle.
2. Ductmate Industries, Inc, a DMI Company: www.ductmate.com/#sle.
3. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

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C. Flexible Duct Connections: Fabric crimped into metal edging strip.

1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz/sq yd.

a. Net Fabric Width: Approximately 2 inches wide.

2. Metal: 3 inches wide, 24 gauge, 0.0239 inch thick galvanized steel.

D. Leaded Vinyl Sheet: Minimum 0.55 inch thick, 0.87 lbs per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.

E. Maximum Installed Length: 14 inch.

2.8 SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555S, and as indicated.

B. Dampers: UL Class 1 airfoil blade type smoke damper, normally open automatically operated by pneumatic actuator.

C. Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled.

2.9 VOLUME CONTROL DAMPERS

A. Manufacturers:

1. AireTechnologies, Inc, a DMI Company: www.airetechnologies.com/#sle.
2. Louvers & Dampers, Inc, a brand of Mestek, Inc: www.louvers-dampers.com/#sle.
3. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.
4. MKT Metal Manufacturing: www.mktduct.com/#sle.
5. Nailor Industries, Inc: www.nailor.com/#sle.
6. NCA, a brand of Metal Industries Inc: www.ncamfg.com/#sle.
7. Pottorff: www.pottorff.com/#sle.
8. Ruskin Company: www.ruskin.com/#sle.
9. United Enertech: www.unitedenertech.com/#sle.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Splitter Dampers:

1. Material: Same gauge as duct to 24 inches size in either direction, and two gauges heavier for sizes over 24 inches.

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2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
3. Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw.

D. Single Blade Dampers:
1. Fabricate for duct sizes up to 6 by 30 inch.
2. Blade: 24 gauge, 0.0239 inch, minimum.

E. Multi-Blade Damper: Fabricate consisting of opposed blades with maximum blade sizes 8 by 72 inches. Assemble center- and edge-crimped blades in prime-coated or galvanized-channel frame with suitable hardware.
1. Blade: 18 gauge, 0.0478 inch, minimum.

F. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.

2.10 LOW LEAKAGE (CLASS 1A) CONTROL DAMPERS

A. Manufacturers:
1. Tamco.

B. Maximum Leakage Allowed: 3 cfm/sq ft at 1 in-wc.

C. Frame:
1. Material: 20-gauge aluminum.
2. Free-area: Single cross section.
3. Blanked-off: Split frame into two free-area sections to allow a smaller free-area to be used for a minimum airflow intake or exhaust application and secondary free-area fully blanked-off.

D. Blade:
1. Type: Single-blade rectangle shape.
2. Operation: Opposed type.
3. Maximum Individual Blade Height: 8 inches.
4. Material: 12-gauge galvanized steel.
5. Authority: Opposed type, 5 to 50 percent (typically 10 percent).

E. Insulation: Water-resistant sound absorbing material.

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F. Temperature Service Range: Minus 25 to 185 degrees F.

G. Other Requirements:

1. Paint Finish: Standard.
2. Rust Inhibitor Coating: Moisture and salt water-resistant.
3. Sleeve or Flange: Factory-mounted standard.
4. Duct Transition Fitting: Round.

2.11 MISCELLANEOUS PRODUCTS

A. Internal Strut End Plugs: Combination end-mounting and sealing plugs for metal conduit used as internal reinforcement struts for metal ducts; plug crimped inside conduit with outside gasketed washer seal.

B. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.

1. Thickness: 2 mils.
2. High tack water based adhesive.
3. UV stable light blue color.
4. Elongation Before Break: 325 percent, minimum.
5. Manufacturers:
   a. Carlisle HVAC Products; Dynair Duct Protection Film: www.carlislehvac.com/#sle.
   b. Elgen Manufacturing Company, Inc; Shrink Wrap with PSA: www.elgenmfg.com/#sle.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 23 31 00 for duct construction and pressure class.

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B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 12 by 12 inch size access door for hand and shoulder access, or as indicated on drawings. Provide minimum 4 by 4 inch size access door for balancing dampers only. Review locations prior to fabrication.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire-rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

F. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.

G. Demonstrate re-setting of fire dampers to CPL's representative.

H. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

I. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

J. For fans developing static pressures of 3 inches and over, cover flexible connections with leaded vinyl sheet, held in place with metal straps.

K. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum two duct widths from duct take-off.

L. Use splitter dampers only where indicated.

M. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION 23 33 00

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SECTION 23 36 00 - AIR TERMINAL UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single-duct terminal units.
   1. Variable-volume units.
B. Hose kits and valves.
C. Controls for terminal units.

1.2 RELATED REQUIREMENTS

A. Section 23 05 13 - Common Motor Requirements for HVAC Equipment.
B. Section 23 05 48 - Vibration and Seismic Controls for HVAC.
C. Section 23 09 13 - Instrumentation and Control Devices for HVAC: Thermostats and actuators.
D. Section 23 09 23 - Direct-Digital Control System for HVAC.
E. Section 23 09 93 - Sequence of Operations for HVAC Controls.
F. Section 23 21 13 - Hydronic Piping: Connections to heating coils.
G. Section 23 21 14 - Hydronic Specialties: Connections to heating coils.
H. Section 23 31 00 - HVAC Ducts and Casings.
I. Section 23 33 00 - Air Duct Accessories.
J. Section 23 37 00 - Air Outlets and Inlets.
K. Section 23 82 00 - Convection Heating and Cooling Units: Air coils.

1.3 REFERENCE STANDARDS

A. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils; 2001, with Addenda (2011).
B. AHRI 880 (I-P) - Performance Rating of Air Terminals; 2017 (Reaffirmed 2023).
C. AHRI 885 - Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets; 2008, with Addendum (2011).
D. ASHRAE RP-1455 - Seminar 65 - Standardized Best of Class Sequences for HVAC Systems; 2016.

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E. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2025.

F. ASHRAE Std 62.1 - Ventilation for Acceptable Indoor Air Quality; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. ASHRAE Std 130 - Laboratory Methods of Testing Air Terminal Units; 2025.

H. ASTM A492 - Standard Specification for Stainless Steel Rope Wire; 1995 (Reapproved 2019).

I. ASTM A603 - Standard Specification for Metallic-Coated Steel Structural Wire Rope; 2019.

J. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2025.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

L. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete Elements; 2022.

M. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

N. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

O. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

P. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2024.

Q. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

R. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

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

B. Sequencing: Completion utility connections in an orderly and expeditious manner.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

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B. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate airflow, static pressure, and NC designation. Include electrical characteristics and connection requirements.

C. Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.

1. Include schedules listing discharge and radiated sound power level for each of the second through sixth-octave bands at inlet static pressures of 1 to 4 in-wc.

D. Certificates: Certify that coils are tested and rated in accordance with AHRI 410.

E. Manufacturer's Installation Instructions: Indicate support and hanging details, installation instructions, recommendations, and service clearances required.

F. Project Record Documents: Record actual locations of units and locations of access doors required for access of valving.

G. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant-volume regulators.

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

1.6 QUALITY ASSURANCE

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

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 WARRANTY

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

B. Provide five year manufacturer warranty for air terminal units.

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PART 2 PRODUCTS

2.1 SINGLE-DUCT, VARIABLE-VOLUME UNITS

A. Manufacturers:

1. Price Industries; _____: www.priceindustries.com/#sle.
2. Trane Technologies, PLC; _____: www.trane.com/#sle.
3. Siemens.

B. General:

1. Factory-assembled, AHRI 880 (I-P) rated and bearing the AHRI seal, air volume control terminal with damper assembly, flow sensor, externally mounted volume controller, duct collars, and all required features.
2. Control box bearing identification, including but not necessarily limited to nominal cfm, maximum and minimum factory-set airflow limits, coil type and coil (right or left hand) connection, where applicable.

C. Unit Casing:

1. Minimum 22 gauge, 0.0299 inch galvanized steel.
   a. Assembled with longitudinal lock seam construction.
   b. Casing leakage to meet ASHRAE Std 130.
2. Air Inlet Collar: Provide round, suitable for standard flexible duct sizes.
3. Unit Discharge: Rectangular, with slip-and-drive connections.
4. Acceptable Liners:
   a. 3/4 inch thick polyurethane foam adhesive complying with UL 181 erosion requirements in accordance with ASHRAE Std 62.1, and having a maximum smoke developed index of 50 for both insulation and adhesive, when tested in accordance with ASTM E84.
   b. Liner not to contain pentabrominated diphenyl ether (CAS #32534-81-9) or octabrominated diphenyl ether.

D. Damper Assembly:

1. Heavy-gauge, galvanized steel, or extruded aluminum construction with solid steel, nickel-plated shaft pivoting on HDPE, self-lubricating bearings.
2. Provide integral position indicator or alternative method for indicating damper position over full range of 90 degrees.

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3. Incorporate low leak damper blades for tight airflow shutoff.
    a. Air Leakage Past Closed Damper: Maximum two percent of unit maximum airflow at 3 in-wc inlet static pressure, tested in accordance with ASHRAE Std 130.

E. Hot Water Heating Coil:
1. Coil Casing: Minimum 22 gauge, 0.0299 inch galvanized steel, factory-installed on terminal discharge with rectangular outlet, duct connection type.
    a. Access Door: Gasketed and insulated located on bottom, on top, and downstream of coils.
    b. Right or left coil inlets.
2. Coil Fins: Aluminum or aluminum plated fins, mechanically-bonded to seamless copper tubes.
    a. Fins to be formed in a high heat transfer sine wave configuration.
3. Coil leak tested to minimum 350 psig.
    a. Minimum Burst Pressure: 1800 psi.
4. Base performance data on tests run in accordance with AHRI 410 and units to bear AHRI 410 label.

F. Controls:
1. DDC (Direct-Digital Controls):
    a. Include a factory-installed, unit-mounted, direct-digital controller.
    b. Bi-directional Damper Actuator: 24 volt, powered closed, spring return open.
    c. Microprocessor-Based Controller: Air volume controller, pressure-independent with electronic airflow transducers, factory-calibrated maximum and minimum CFMs.
        1) Occupied and unoccupied operating mode.
        2) Remote reset of temperature or CFM set points.
        3) Proportional, plus integral control of room temperature.
        4) Monitoring and adjusting with portable terminal.
        5) Time-proportional reheat coil control.
    d. Room Sensor:
        1) Compatible with temperature controls specified.
        2) Wall-mounted, system powered, with temperature set-point adjustment including connection access for portable operator terminal.
    e. See Section 25 1400.

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2. Airflow Sensor: Differential pressure airflow device measuring total, static, and wake pressures.
    a. Signal accuracy: Plus/minus five percent throughout terminal operating range.

2.2 HOSE KITS AND VALVES

A. Manufacturers:
    1. Griswold Controls; _____: www.griswoldcontrols.com/#sle.
    2. Hays Fluid Controls; _____: www.haysfluidcontrols.com/#sle.
    3. IMI Flow Design, a brand of IMI Hydronic Engineering Division of IMI plc; _____: www.flowdesign.com/#sle.

B. Hoses:
    1. Provide hoses for all units for connection to main water supply and return headers.
    2. Length: 2 feet.
    3. Material: Braided stainless steel rated to minimum 400 psi at 265 degrees F.

C. Ball Valves:
    1. Brass body for shutoff and hydronic balancing.
    2. Provide pressure/temperature ports.
    3. Provide balancing valves.

D. Y Strainers:
    1. Bronze body.
    2. "Y" type configuration with brass cap.
    3. Maximum Operating Pressure: Minimum 450 psi.
    4. Screen: Stainless steel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that conditions are suitable for installation.

B. Verify that field measurements are as indicated on drawings.

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3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install the inlets of air terminal units and air flow sensors a minimum of four duct diameters from elbows, transitions, and duct takeoffs.

C. See drawings for the size(s) and duct location(s) of the air terminal units.

D. Provide ceiling access doors or locate units above easily removable ceiling components.

E. Support units individually from structure with wire rope complying with ASTM A492 and ASTM A603 in accordance with SMACNA (SRM). See Section 23 0548.

F. Embed anchors in concrete in accordance with ASTM E488/E488M.

G. Do not support from ductwork.

H. Connect to ductwork in accordance with Section 23 31 00.

I. Provide minimum of 5 ft of 1 inch thick lined ductwork downstream of units.

J. Install heating coils in accordance with Section 23 82 00.

K. Verify that electric power is available and of the correct characteristics.

3.3 ADJUSTING

A. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design flow to zero percent full flow. Set units with heating coils for minimum 50 percent full flow.

3.4 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Provide manufacturer's field representative to test, inspect, instruct, and observe field-assembled components and equipment installation, including connections and to assist in field testing. Report results in writing.

1. Leak Test:
    a. After installation, fill water coils and test for leaks.
    b. Repair leaks and retest until no leaks exist.
2. Operational Test:
    a. After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

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b. Test and adjust controls and safeties.

c. Replace damaged and malfunctioning controls and other equipment.

d. Remove and replace malfunctioning units and retest as specified above.

3.5 CLEANING

A. Vacuum clean coils and inside of units.

B. Install new filters.

3.6 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training for additional requirements.

END OF SECTION 23 36 00

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SECTION 23 37 00 - AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Diffusers:

B. Rectangular ceiling diffusers.

C. Slot ceiling diffusers.

D. Registers/grilles:

1. Ceiling-mounted, egg crate exhaust and return register/grilles.
2. Ceiling-mounted, exhaust and return register/grilles.
3. Ceiling-mounted, linear exhaust and return register/grilles.
4. Ceiling-mounted, supply register/grilles.
5. Wall-mounted, supply register/grilles.
6. Wall-mounted, exhaust and return register/grilles.

E. Wall and ceiling gypsum board access panels.

1.2 REFERENCE STANDARDS

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2023.

B. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Air Inlets; 2023.

C. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.3 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

C. Project Record Documents: Record actual locations of air outlets and inlets.

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1.4 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

B. Test and rate louver performance in accordance with AMCA 500-L.

C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.5 MOCK-UP

A. Provide mock-up of typical exterior ceiling module with supply and return air outlets.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Krueger-HVAC; _____: www.krueger-hvac.com/#sle.

B. Price Industries; _____: www.priceindustries.com/#sle.

C. Titus, a brand of Air Distribution Technologies; _____: www.titus-hvac.com/#sle.

2.2 RECTANGULAR CEILING DIFFUSERS

A. Type: Provide rectangular and square formed adjustable, backpan stamped, core removable, and multi-louvered ceiling diffusers constructed to maintain 360 degree discharge air pattern with sectorizing baffles where indicated.

B. Connections: Round.

C. Frame: Provide surface mount, snap-in, inverted T-bar, and spline type. In plaster ceilings, provide plaster frame and ceiling frame.

D. Fabrication: Steel with baked enamel finish.

E. Color: As indicated.

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2.3 CEILING SLOT DIFFUSERS

A. Type: Continuous 1/2 inch wide slot, 1 slots wide, with adjustable vanes for left, right, or vertical discharge; integral ceiling fire damper.

B. Fabrication: Aluminum extrusions with factory clear lacquer finish.

C. Color: As indicated.

D. Plenum: Integral, galvanized steel, insulated.

2.4 CEILING SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, one-way deflection.

B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

C. Construction: Made of stainless steel.

D. Color: As indicated.

2.5 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with blades set at 45 degrees, vertical face.

B. Frame: 1-1/4 inch margin with countersunk screw mounting.

C. Fabrication: Steel with 20 gauge, 0.0359 inch minimum frames and 22 gauge, 0.0299 inch minimum blades, steel and aluminum with 20 gauge, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.

D. Color: As indicated.

2.6 CEILING LINEAR EXHAUST AND RETURN GRILLES

A. Type: Streamlined blades with 90 degree one-way deflection, 1/8 by 3/4 inch on 1/4 inch centers.

B. Frame: 1-1/4 inch margin, extra heavy for floor mounting, with countersunk screw mounting.

C. Fabrication: Steel with 20 gauge, 0.0359 inch minimum frames and 22 gauge, 0.0299 inch minimum blades, steel and aluminum with 20 gauge, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.

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2.7 CEILING EGG CRATE EXHAUST AND RETURN GRILLES

A. Type: Egg crate style face consisting of 1/2 by 1/2 by 1/2 inch grid core.

B. Fabrication: Grid core consists of aluminum with mill aluminum finish.

C. Frame: Channel lay-in frame for suspended grid ceilings.

D. Accessories: Provide integral gang and face operated opposed blade damper, 2 inch filter frame, plaster frame, square mesh insect screen, square mesh debris screen, prescored molded fiberglass back, and 45 degree angled eggcrate or other similar provisions for visual blocking such as angled louver or 90 degree duct elbow.

2.8 WALL SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing with spring or other device to set blades, vertical face, single deflection.

B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

C. Fabrication: Steel with 20 gauge, 0.0359 inch minimum frames and 22 gauge, 0.0299 inch minimum blades, steel and aluminum with 20 gauge, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.

D. Color: As indicated.

2.9 WALL EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with spring or other device to set blades, vertical face.

B. Frame: 1-1/4 inch margin with countersunk screw mounting.

C. Fabrication: Steel frames and blades, with factory baked enamel finish.

D. Color: As indicated on the drawings.

2.10 WALL AND CEILING GYPSUM BOARD ACCESS PANELS

A. Gypsum Board Access Panels: Provide rectangular access panel with recessed and gasketed aluminum perimeter frame that acts as finishing edge and having concealed mechanical touch-latch with safety cable.

1. Panel Frame Size: 24 by 24 inch set within 1/2 inch thick gypsum board.

2. Panel Style: Standard style.

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3. Panel Frame: 1 inch margin with concealed countersunk screw mounting.

2.11 LINEAR WALL REGISTERS/GRILLES

A. Type: Streamlined blades with 0 degree deflection, 1/8 by 3/4 inch on 1/4 inch centers.

B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

C. Fabrication: Aluminum extrusions, with factory baked enamel finish.

D. Color: As indicated.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Comply with SMACNA (ASMM) for flashing/counter-flashing of roof penetrations and supports for roof curbs and roof mounted equipment.

C. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.

D. Install diffusers to ductwork with air tight connection.

E. Provide balancing dampers on duct take-off to diffusers and grilles and registers, despite whether dampers are specified as part of diffuser, or grille and register assembly.

F. Paint ductwork visible behind air outlets and inlets matte black, see Section 09 91 23.

G. For Installation of Fan Filter Units:

1. Do not begin installation until substrates and openings have been properly prepped.
2. Verify location of cleanroom fan filter units for installation.
3. Verify supports, surfaces, and openings are ready for fit out.
4. Clean and prepare surfaces per manufacturer's instructions.
5. Install in accordance with manufacturer's written instructions and recommendations and in proper relationship with adjacent work.
6. Rigidly mount fan filter units level and plumb with fasteners recommended by manufacturer.
7. Startup equipment in accordance with manufacturer's instructions.
8. Seal perimeter of both sides of openings as required.

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9. Record changes to system design that differs from what is shown on drawings.

3.2 CLOSEOUT ACTIVITIES

A. Demonstrate operational system to Owner's representative.

B. Instruct Owner's representative to maintain system and use occupant controls or interfaces, as required.

3.3 PROTECTION

A. Protect installed products until completion of project.

B. Replace, repair, or touch-up damaged products before Substantial Completion.

END OF SECTION 23 37 00

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SECTION 23 52 16 - CONDENSING BOILERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Manufactured units.

B. Boiler construction.

C. Boiler trim.

D. Fuel burning system.

E. Factory installed controls.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 23 09 13 - Instrumentation and Control Devices for HVAC.

C. Section 23 21 14 - Hydronic Specialties.

D. Section 23 21 23 - Hydronic Pumps.

E. Section 23 25 00 - HVAC Water Treatment.

F. Section 25 14 00 - Integrated Automation Local Control Units.

G. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI); Current Edition.

B. ANSI Z21.13 - American National Standard for Gas-Fired Low-Pressure Steam and Hot Water Boilers; 2022.

C. 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.

D. ASHRAE Std 135 - BACnet - A Data Communication Protocol for Building Automation and Control Networks; 2024, with Errata (2025).

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E. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2025, with Errata.

F. NBBI Manufacturer and Repair Directory - The National Board of Boiler and Pressure Vessel Inspectors (NBBI); Current Edition.

G. NFPA 54 - National Fuel Gas Code; 2024.

H. SCAQMD 1146.1 - Emissions of Oxides of Nitrogen from Small Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters; 1990, with Amendment (2018).

1.4 ADMINISTRATIVE REQUIREMENTS

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

B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittals procedures.

B. Product Data: Provide data indicating general assembly, components, controls, safety controls, and wiring diagrams with electrical characteristics and connection requirements, and service connections.

C. Manufacturer's Installation Instructions: Indicate assembly, support details, connection requirements, and include start up instructions.

D. Manufacturer's Factory Inspection Report: Submit boiler inspection prior to shipment.

E. Manufacturer's Field Reports: Burner manifold gas pressure, percent carbon monoxide (CO), percent oxygen (O), percent excess air, flue gas temperature at outlet, ambient temperature, net stack temperature, percent stack loss, percent combustion efficiency, and heat output.

1. Indicate compliance with specified performance and efficiency.

F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, cleaning procedures, replacement parts list, and maintenance and repair data.

G. Warranty: Submit manufacturer warranty and ensure forms have been completed in CPL's name and registered with manufacturer.

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1.6 QUALITY ASSURANCE

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

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect boilers from damage by leaving factory inspection openings and shipping packaging in place until final installation.

1.8 WARRANTY

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

B. Provide a five year warranty to include coverage for heat exchanger.

PART 2 PRODUCTS

2.1 OWNER-FURNISHED PRODUCTS

2.2 MANUFACTURERS

A. Natural Gas, Propane, or Combination Natural Gas/Propane for Indoor Applications:

1. Lochinvar LLC: www.lochinvar.com/#sle.
2. The Fulton Companies: www.fulton.com/#sle.
3. Patterson Kelly - Mach 300 (Basis of design).

2.3 MANUFACTURED UNITS

A. Factory assembled, factory fire-tested, self-contained, readily transported unit ready for automatic operation except for connection of water, fuel, electrical, and vent services.

B. Unit: Metal membrane wall, water or fire tube, condensing boiler on integral structural steel frame base with integral fuel burning system, firing controls, boiler trim, insulation, and removable jacket, suitable for indoor application.

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2.4 BOILER CONSTRUCTION

A. Comply with the minimum requirements of ASME BPVC-IV and ANSI Z21.13 for construction of boilers.

B. Assembly to bear the ASME "H" stamp and comply with the efficiency requirements of the latest edition of ASHRAE Std 90.1 I-P.

C. Required Directory Listings:

1. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI); current edition at www.ahrinet.org.
2. NBBI Manufacturer and Repair Directory - The National Board of Boiler and Pressure Vessel Inspectors (NBBI); current edition at www.nationalboard.org.

D. Heat Exchanger: Construct with materials that are impervious to corrosion where subject to contact with corrosive condensables.

E. Provide adequate tappings, observation ports, removable panels, and access doors for entry, cleaning, and inspection.

F. Insulate casing with insulation material, protected and covered by heavy-gauge metal jacket.

G. Factory apply boiler base and other components, that are subject to corrosion, with durable, acrylic, powder coated, painted, or weather-proofed finish.

2.5 BOILER TRIM

A. ASME rated pressure relief valve.

B. Flow switch.

C. Electronic Low Water Cut-off: Complete with test light and manual reset button to automatically prevent firing operation whenever boiler water falls below safe level.

D. Temperature and pressure gauge.

E. Pressure Switches:

1. High gas pressure.
2. Low gas pressure.
3. Air pressure.

F. Manual reset high limit.

G. Boiler Pump (where required by boiler design):

1. Primary pump, factory supplied and sized for field installation to ensure minimum, continuous circulation through boiler.

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2. Where pump is not provided by boiler manufacturer, provide pump in accordance with boiler manufacturer's recommendations.
3. Pump time delay.

2.6 FUEL BURNING SYSTEM

A. Provide forced draft automatic burner or pulse combustion, integral to boiler, designed to burn natural gas, and maintain fuel-air ratios automatically.
   1. Blower Design: Statically and dynamically balanced to supply combustion air; direct connected to motor.
   2. Forced Draft Design: Mixes combustion air and gas to achieve 90 percent combustion efficiency.
   3. Pulse Combustion Design: Self-aspirating, not requiring blower for combustion.
   4. Combustion Air Filter: Protects fuel burning system from debris.

B. Gas Train: Plug valve, safety gas valve, gas-air ratio control valve, and pressure regulator controls air and gas mixture.

C. Emission of Oxides of Nitrogen Requirements: Comply with SCAQMD 1146.1 for natural gas fired system, as applicable.

D. Intakes: Combustion air intake capable of accepting free mechanical room air or direct outside air through a sealed intake pipe.

2.7 FACTORY INSTALLED CONTROLS

A. Option for internal or external (0-10) VDC control.

B. Temperature Controls:
   1. Automatic reset type to control fuel burning system on-off and firing rate to maintain temperature.
   2. Manual reset type to control fuel burning system to prevent boiler water temperature from exceeding safe system water temperature.
   3. Low-fire start time delay relay.

C. Electronic PI setpoint/modulation control system.

D. Microprocessor-based, fuel/air mixing controls.

E. BAS, SCADA, or other Integrated Automation Link: ASHRAE Std 135 BACnet MS/TP.

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1. External Point Mapping: Provide mapping table for each parameter included in the local visual interface with software-toggle flag to allow reduced mapping of available points.
2. Remotely coordinated by boiler plant demand optimization controller; see Section 25 14 00.

2.8 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Provide factory tests to check construction, controls, and operation of unit.

C. Manufacturer to conduct boiler inspection prior to shipment; submit copy of inspection report to Engineer.

D. Non-Complying Work: See Section 01 40 00.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install boiler and provide connection of natural gas service in accordance with requirements of NFPA 54 and applicable codes.

C. Install boiler on concrete housekeeping base, sized minimum of 4 inches larger than boiler base in accordance with Section 03 30 00.

D. Coordinate factory installed controls with Section 23 09 13.

E. Coordinate provisions for water treatment in accordance with Section 23 25 00.

F. Pipe relief valves to nearest floor drain.

G. Pipe cooled condensate produced by the combustion process from the boiler condensate connection and/or flue stack with suitable piping material to neutralizer prior to discharging into nearest floor drain.

H. Install primary boiler pump in accordance with Section 23 21 23.

I. Provide piping connection and accessories in accordance with Section 23 21 14.

J. Provide for connection to electrical service in accordance with Section 26 05 83.

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3.2 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training for additional requirements.

C. Demonstrate proper operation of equipment to CPL's designated representative.

D. Demonstration: Demonstrate operation of system to CPL's personnel.

1. Use operation and maintenance data as reference during demonstration.
2. Conduct walking tour of project.
3. Briefly describe function, operation, and maintenance of each component.

E. Training: Train CPL's personnel on operation and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.
3. Instructor: Manufacturer's training personnel.
4. Location: At project site.

END OF SECTION 23 52 16

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SECTION 23 74 16 - PACKAGED ROOFTOP AIR-CONDITIONING UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Packaged, intermediate-capacity, rooftop air-conditioning units.

1.2 RELATED REQUIREMENTS

A. Section 23 05 48 - Vibration and Seismic Controls for HVAC.

B. Section 23 09 13 - Instrumentation and Control Devices for HVAC: Control components, time clocks.

C. Section 23 09 13 - Instrumentation and Control Devices for HVAC: Installation of thermostats and other control components.

D. Section 26 05 83 - Wiring Connections: Installation and wiring of thermostats and other control components; wiring from unit terminal strip to remote panel.

E. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

C. Shop Drawings: Indicate capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

D. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.

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E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in CPL's name and registered with manufacturer.

G. Maintenance Materials: Furnish the following for CPL's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements for additional provisions.

1.5 QUALITY ASSURANCE

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

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect units from physical damage by storing off site until roof mounting curbs are in place and ready for immediate installation of units.

1.7 WARRANTY

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

B. Provide a five year warranty to include coverage for refrigeration compressors.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Aaon.

B. Engineered Air.

C. Daikin.

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2.2 PACKAGED, INTERMEDIATE-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

A. General: Roof mounted units having gas burner and electric refrigeration that are 7.5 tons to 25 tons in capacity.

B. Description: Self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan, exhaust fan , heat exchanger and burner, , air filters, refrigerant cooling coil and compressor, condenser coil and condenser fan.

C. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) no greater than that allowed by federal code.

D. Disconnect Switch: Factory mount disconnect switch in control panel.

2.3 CASING

A. Cabinet: Steel with baked enamel finish, including access panels with screwdriver-operated flush, cam type fasteners. Structural members to be minimum 18 gauge, 0.0478 inch, with access doors or panels of minimum 20 gauge, 0.0359 inch.

B. Insulation: 2-inch thick, neoprene-coated glass fiber with edges protected from erosion.

2.4 FANS

A. Supply and Exhaust Fan: Forward curved centrifugal type, resiliently mounted with V-belt drive, and rubber isolated hinge mounted. Provide with high efficiency motor or direct drive as indicated. Isolate complete fan assembly. See Section 23 05 48.

2.5 BURNERS

A. Gas Burner: Forced draft type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition, flame-sensing device, and automatic 100 percent shutoff pilot.

1. Construction: Welded stainless steel.

B. Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after airflow proven and slight delay, allow gas valve to open.

C. High Limit Control: Temperature sensor with fixed stop at maximum permissible setting, de-energize burner on excessive bonnet temperature, and energize burner when temperature drops to lower safe value.

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D. Supply Fan Control: Temperature sensor sensing bonnet temperatures and independent of burner controls, with provisions for continuous fan operation.

2.6 EVAPORATOR COIL

A. Provide copper tube aluminum fin coil assembly with galvanized drain pan and connection.

B. Provide capillary tubes or thermostatic expansion valves for units of 6 tons capacity and less, and thermostatic expansion valves and alternate row circuiting for units 7.5 tons cooling capacity and larger.

2.7 CONDENSER COIL

A. Provide copper tube aluminum fin coil assembly with subcooling rows and coil guard.

B. Provide direct drive propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor. Provide high efficiency fan motors.

C. Provide refrigerant pressure switches to cycle condenser fans.

2.8 COMPRESSORS

A. Provide hermetic compressors, 3600 rpm maximum, resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gauge ports, and filter drier.

B. Provide step capacity control by hot gas bypass.

2.9 AIR FILTERS:

A. 2-inch thick, glass fiber disposable media in metal frames.

2.10 OPERATING CONTROLS

A. RTU manufacturer to provide terminal strip for control of equipment in RTU. The controls contractor, Siemens, will control the RTU's components.

2.11 OPERATING CONTROLS - SINGLE ZONE UNITS

A. Provide terminal strip for integration into the building's BMS.

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2.12 ROOF CURBS

A. Roof Mounting Curb: 14 inches high, galvanized steel, channel frame with gaskets, nailer strips.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that roof is ready to receive work and opening dimensions are as required by manufacturer.

B. Verify that proper power supply is available.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NFPA 90A.

C. Mount units on factory built roof mounting curb providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.

D. Locate remote panels where indicated on drawings.

3.3 SYSTEM STARTUP

A. Prepare and start equipment. Adjust for proper operation.

3.4 CLOSEOUT ACTIVITIES

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

B. See Section 01 79 00 - Demonstration and Training for additional requirements.

C. Demonstrate proper operation of equipment to CPL's designated representative.

3.5 MAINTENANCE

A. Provide service and maintenance of packaged rooftop units for one year from Date of Substantial Completion.

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B. Provide routine maintenance service with a two-month interval as maximum time period between calls.

C. Include maintenance items as outlined in manufacturer's operating and maintenance data, including minimum of six filter replacements, minimum of one fan belt replacement, and controls check-out, adjustments, and recalibration.

D. Provide 24-hour emergency service on breakdowns and malfunctions.

E. After each service call, submit copy of service call work order or report that includes description of work performed.

END OF SECTION 23 74 16

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SECTION 23 83 13 - RADIANT-HEATING ELECTRIC CABLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electric heating cables for roof and gutter de-icing with the following electric heating cables:

1. Roof Ice Melt Concealed Roof De-Icing: Self-regulating, parallel resistance.

1.2 REFERENCE STANDARDS

A. IEEE 515.1 - IEEE Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications; 2022.

B. ISO 9001 - Quality Management Systems — Requirements; 2015, with Amendment (2024).

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 515 - Standard for Electrical Resistance Trace Heating for Commercial Applications; 2ed.

E. UL 1588 - Outline of Investigation for Roof and Gutter De-Icing Cable Units; 4ed.

1.3 RELATED REQUIREMENTS

A. Section 07 61 13 - Standing Seam Sheet Metal Roofing and Wall Cladding.

B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

C. Section 26 24 16 - Panelboards.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: For each type of product.

1. Include the following:

a. Heating product data sheet.

b. UL-listed certificates for heating product.

c. System installation and operation manual.

d. System installation details.

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e. Connection kits and accessories data sheet.

f. Controller/thermostat data sheet.

g. Controller/thermostat wiring diagram.

2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

3. Schedule heating capacity, length of cable, and electrical power requirement for each electric heating cable required.

4. Include design calculations for each application.

C. Shop Drawings: For electric heating cable.

1. Include plans, sections, and attachment details.

2. Include diagrams for power, signal, and control wiring.

3. Manufacturer to produce detailed design as described below.

4. Roof De-Icing Layout Drawings: Drawings to be provided, including the following:

a. Location/identification of area to be traced.

b. Area dimensions.

c. Heater circuit number.

d. Electrical load.

e. Heater catalog numbers.

f. Heater termination points.

g. Startup temperature.

h. Location of all components.

i. Material list and quantities of all components.

j. Heating cable layout.

5. Roof De-Icing Installation Detail Drawings: Project-specific Detail Drawings including details showing the following:

a. Downspout details.

b. Cable layout details.

c. Installation details.

d. Junction box.

e. Sensor.

6. Control Panel Drawings: Drawings for each control panel to include the following:

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a. Physical arrangement and structural Detail Drawings.

b. Complete power and control wiring diagrams showing all internal wiring connections for electrical and instrument components in each control panel. All wires, terminals, and devices are numbered and tagged in accordance with system elementary diagrams.

7. System Wiring Diagram: Project-specific Drawings including the following:

a. Interconnect of all major components.

b. Assignment of circuiting.

c. Connection of circuit wiring in terminal blocks.

d. Connection of sensor wiring.

e. Connection of external alarm wiring.

8. Controller Set-Point Schedule showing the following:

a. Circuit addresses.

b. Circuit set points.

c. Circuit alarms and settings.

D. Testing Instructions and Reporting Form: Provide documentation for use in preinstallation testing of heat tracing system.

E. Field quality-control reports.

F. Sample Warranty: For special warranty.

G. Operation and Maintenance Data: For electric heating cables to include in operation and maintenance manuals.

H. Testing: Completed system test report.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. ISO 9001 registered.

2. Provide products consistent with UL 515, UL 1588, and IEEE 515.1 requirements.

B. Installer Qualifications:

1. System Installer to have complete understanding of product and product literature from manufacturer or authorized representative prior to installation.

2. Electrical connections to be performed by licensed electrician.

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C. Certification: System (Heating Cable, Connection Kits, and Controller): UL-listed, CSA-certified roof and gutter de-icing, surface snow melting, and/or floor-heating systems.

D. Testing: Heating cable for roof and gutter de-icing, surface snow melting, and floor-heating systems to be qualified and tested to demonstrate a useful lifetime in excess of 20 years.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in original, unopened containers or packages with intact and legible manufacturers' labels identifying the following:

1. Product and /manufacturer.
2. Length/quantity.
3. Lot number.
4. Installation and operation manual.
5. Material safety data sheet (MSDS) (if applicable).

B. Store heating cable in clean, dry location with a temperature range of 0 to 140 deg F (-18 to 60 deg C).

C. Protect heating cable or extrusions from mechanical damage.

D. Protect heating cable ends from moisture ingress until final termination of heating cable is complete.

1.7 WARRANTY

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

B. Manufacturer's Warranty: Provide Owner an extended product warranty for heat tracing products described below.

1. Contractor must complete and forward to Owner the Installation, Inspection, or Commissioning Record(s), and complete manufacturer's online warranty registration form within 30 days from date of installation; otherwise, only standard limited warranty applies.
2. Warranty Period for Heating Cable: 10 years from date of Substantial Completion.
3. Warranty Period for Concealed Roof Ice Melt Panels and Components: 20 years from date of Substantial Completion.
4. Heating cables, panels, and components not automatically offered with an extended manufacturer's warranty, as a standard matter of course, will not be allowed.

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5. Warranty information must be published on manufacturer's website.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS FOR ELECTRIC HEATING CABLES

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. Source Limitations: All system components to be sourced from a single manufacturer, under no circumstances are any components installed other than those supplied by cable manufacturer, to ensure system integrity and to meet warranty requirements.

2.2 SELF-REGULATING, PARALLEL-RESISTANCE HEATING CABLES – ROOF ICE MELT CONCEALED ROOF DE-ICING

A. Basis-of-Design Product: Subject to compliance with requirements, provide RAYCHEM; a brand of Chemelex; RIM Roof Ice Melt System or comparable product by one of the following:

1. Chromalox.
2. Summit Ice Melt Systems.

B. System Description: Complete concealed roof ice melt system that consists of heating cables secured in extruded-aluminum panels in a fixed heat-transfer position specifically designed for eaves, valleys, channels, rakes, and flat roof sections; ambient, surface, and moisture sensing control; and monitoring, with integrated ground-fault circuit protection and Building Management System (BMS) communication capabilities.

C. Compliance: UL 515 , UL 1588, and IEEE 515.1.

D. Roof Ice Melt Panels:

1. Roof ice melt panels consist of aluminum extrusions with channels designed to fit the self-regulating heating cables. To prevent roof damage, extrusions do not have any protrusions perpendicular to roof surface.
2. To ensure maximum output from heating cables, aluminum extrusion and heating cable are manufactured by same manufacturer and specifically for the heating cable being used.
3. Roof ice melt panels are specifically designed for eaves, valleys, channels, rakes, and low-pitch roof sections.

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4. Roof ice melt extrusion designed to mount under the roof surface so that the entire panel is hidden, with base panel and extrusion.
    a. Contains channels for two runs of cable (i.e., cable length is double the extrusion length).
    b. Power output: 24 W/ft.
    c. Basis-of-Design Product: RAYCHEM; RIM-SC.

E. Heating Cable:
1. Heating Element: Pair of parallel No. 16 AWG, nickel-coated, stranded copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled, nonheating leads with connectors at one end, and seal the opposite end watertight. Cable is capable of crossing over itself once without overheating.
2. Electrical Insulating Jacket: Modified polyolefin.
3. Voltage: 120 V without use of transformers.
4. Power Output: 12 W/ft of cable.
5. Cable Cover: Tinned-copper braid with polyolefin outer jacket.
    a. Outer jacket printed with cable model number, agency listings, batch number, and meter marks (for ease of installation within maximum circuit length).
6. Heating cable is part of a UL-listed and CSA-certified system.
7. Basis-of-Design Product: RAYCHEM; IceStop GM-1X.

F. Heating Cable Connection Kits:
1. Heating cable circuits are connected to power wiring in an approved junction box with approved termination components.
2. Manufacturer provides power connection, splice/tee, and end seal kits compatible with selected heating cable.
3. Connection kits to be UL-listed and CSA-certified.
4. Basis-of-Design Products (RAYCHEM):
    a. Heat shrink power connection and end seal: RIM WPCK-R.
    b. Heat shrink splice or tee kit designed for RIM systems: RIM FTC-HST-PLUS.
    c. Weather-tight junction box: RIM JB-55 or RIM JB-75

G. Heating Cable Installation Accessories:

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1. Cable cover bracket to be used to enhance the heat transfer from heating cable to the snow and create larger drain paths in gutters and downspouts.
    a. Basis-of-Design Product: RAYCHEM; RIM-CABLE COVER BRACKET (RIM-CCB).
2. Downspout Hangers: Use to provide mechanical protection and strain relief to heating cable as it goes over sharp edges and to hold the heating cable in place at top of downspouts.
    a. Basis-of-Design Product: RAYCHEM; DSH.
3. Sealant: A silicone based adhesive compatible with the roof ice melt system.
    a. Basis-of-Design Product: RAYCHEM; RIM Adhesive.

H. Controls:

1. Control Panel:
    a. Description: Controller to determine when to start heater operation by monitoring the signals produced by up to six powered environmental sensors as well as a temperature sensor for high-limit cutout.
    b. The Hold-On Timer: Used to continue heater operation, to manually operate heaters, or to provide a limited heater cycle for testing. During normal operation, the hold-on Timer continues heater operation for an adjustable time period of up to 10 hours after snow stops. The additional operating time compensates for the fact that there may be insufficient power to both melt the snow as it falls and evaporate the resultant melt water.
    c. Building Management System (BMS) Interface: Interface with an BMS via relays or contact closure. Inputs from the BMS include Override On, which causes heater operation, and Override Off, which inhibits heater operation. Outputs to the BMS consist of fifive system status contact closures including Supply, Snow, Heater, Alarm, and Temperature Limit status.
        1) Contacts: 10 mA dry switch contact.
    d. User Interface:
        1) LED status indicators for Supply, Snow, Heater, Alarm, Temp Limit, EMC (aka BMS).
        2) Adjustment knobs for High Temperature Limit and Hold-On Timer.
        3) Heater Cycle toggle switch for manual starting/stopping of a heater cycle.
    e. Supply Voltage: 120 V.
    f. Form C Output Contact Ratings:
        1) Maximum Voltage: 240 V.

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2) Maximum Current: 24 A.

g. Basis-of-Design Product: RAYCHEM; APS-3C.

2. Sensors:

a. Aerial Snow Sensor (Snow Owl):

1) Description: Automatic snow sensor with UV-resistant plastic housing with heated moisture-sensing grid.

2) Mounting: Mast or roof mounting on 3/4” PVC or 1/2” PVC with optional reducing bushing or 1/2” NPT.

3) Input Power: 24V AC 50/60Hz, 24V DC, or 24V full wave rectified AC/pulsed DC 0.2A max

4) Output: Relay contacts: 2A max, 30V. Relay contacts close when ambient temperature is at or below the set point temperature and precipitation is detected. Relay contacts remain closed during pre-set delay after snow event ends.

5) Connection: Three 18 AWG jacketed pigtail wires (white, black, red).

6) Maximum cable length: Up to 500 ft (152 m) using 18 AWG 3-wire jacketed cable.

7) Basis-of-Design Product: RAYCHEM; CIT-1.

b. Gutter Ice Sensor:

1) Description: Automatic ambient air and moisture sensor for installation in gutter or downspouts.

2) Input Power: 24V AC 50/60Hz, 24V DC, or 24V full wave rectified AC/pulsed DC 0.2A max.

3) Output: Relay contacts: 2A max, 30V. Relay contacts close when ambient temperature is at or below the set point temperature and precipitation is detected. Relay contacts remain closed during pre-set delay after snow event ends.

4) Connection: Three 18 AWG jacketed pigtail wires (white, black, red).

5) Maximum cable length: Up to 500 ft (152 m) using 18 AWG 3-wire jacketed cable.

6) Basis-of-Design Product: RAYCHEM; GIT-1.

I. Approval:

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1. System (heating cable, connection kits, and controller) to be UL-listed for roof and gutter de-icing.
2. Roof ice melt system has design, installation, and operating manual specific to roof ice melting.

2.3 SYSTEM APPROVAL

A. Complete system (heating cable, connection kits, and controller/thermostat) to be listed by a nationally recognized testing laboratory (NRTL).

PART 3 EXECUTION

3.1 EXAMINATION:

A. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. Ensure that surfaces in contact with electric heating cables are free of burrs and sharp protrusions.
   2. Ensure that surfaces and substrates are level and plumb.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION:

A. Protect all heating cable ends from moisture ingress until cable is terminated with end seals.

3.3 INSTALLATION:

A. Install electric heating cable and panels in accordance with Drawings and manufacturer's installation and operation manuals.

B. Coordinate installation with roofing contractor or other trades as outlined in Section 07 61 13 - Standing Seam Sheet Metal Roofing and Wall Cladding.

C. Installer to be responsible for providing complete functional system, installed in accordance with applicable national and local requirements.

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3.4 ELECTRICAL:

A. Ground equipment in accordance with Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. All electric heating cable circuits shall include Ground-Fault Protection for Equipment (GFPE) at the circuit breaker with a trip setting of 30 mA (see Section 26 24 16 - Panelboards).

C. Connect wiring in accordance with Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

3.5 FIELD QUALITY CONTROL:

A. Manufacturer's Field Service: Initial start-up and field testing (commissioning) of system is performed by factory technician in accordance with Owner's requirements.

B. In the field, all heating cables are meggered with a minimum of 2,500 V dc for self-regulating cable (1000 V dc for mineral insulated cable). Follow all manufacturer’s recommended installation tests specific to application printed in installation manual.

C. Final tests must meet manufacturer’s specifications and be submitted to Owner.

D. Electric heating cables will be considered defective if they do not pass tests and inspections in accordance with manufacturer’s requirements.

E. Technician to verify that BMS inputs and outputs are configured correctly.

F. Prepare test and inspection reports.

3.6 CLOSEOUT ACTIVITIES:

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

B. Submit completed final test and inspection reports.

C. Comissioning: Provide a factory-certified technician or manufacturer’s representative for start-up and commissioning of heat tracing system and controller. Incorporate roof ice melt system into HVAC Commissioning Plan.

D. See Section 01 79 00 - Demonstration and Training for additional requirements.

E. Demonstrate operation of equipment to CPL's designated representative.

F. Training: Train CPL's personnel on operation and maintenance of system.

1. Training Reference: Operation and maintenance manual and additional training materials as required.

2. Provide minimum of two hours of training.

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3. Instructor: Manufacturer's training personnel.

3.7 PROTECTION:

A. Comply with manufacturer's written instructions for maintenance service.

END OF SECTION 23 83 13

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SECTION 26 05 05 - SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical demolition.

PART 3 EXECUTION

2.1 EXAMINATION

A. Verify that abandoned wiring and equipment serve only abandoned facilities.

B. Report discrepancies to Engineer before disturbing existing installation.

C. Beginning of demolition means installer accepts existing conditions.

2.2 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Coordinate utility service outages with utility company.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.

E. Temporary Power for Construction: Provide temporary power for use during demolition and construction. Wiring methods for temporary power shall be in accordance with NFPA 70, Article 590.

1. Obtain permission from CPL at least 24 hours before partially or completely disabling system.

2. Electrical contractor shall coordinate with the general contractor to determine how many circuits would be required to serve the needs of all contractors throughout the project. Reserve the required quantity of circuits (but not less than three 120V 20A

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circuits) either as separate individual breakers or with breaker ties to act as a multi-pole breakers for temporary power.

3. At each of the temporary power locations, provide temporary power pedestals or a power outlet unit as required for construcion equipment power. All 120V receptacles shall be provided with GFCI protection (either at the outlet or inline).
4. Provide temporary lighting throughout the scope area powered from the above 120V circuits. The lighting level shall be sufficient to ensure the safety of the construction team in all scope areas. Temporary lighting may be cord-and-plug-connected or may be directly wired.
5. Once the new panels have been furnished, installed, and powered, the temporary construction power shall be migrated to these panels. At that time, any existing-to-be-demolished sources of power and associated equipment shall be demolished.

F. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Minimize outage duration.

1. Notify CPL before partially or completely disabling system.
2. Notify local fire service.
3. Make notifications at least 24 hours in advance.

2.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove, relocate, and extend existing installations to accommodate new construction.

B. Remove abandoned wiring to source of supply.

C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

D. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

E. Disconnect and remove abandoned panelboards and distribution equipment.

F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

G. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

H. Repair adjacent construction and finishes damaged during demolition and extension work.

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I. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

2.4 CLEANING AND REPAIR

A. See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.

B. Clean and repair existing materials and equipment that remain or that are to be reused.

C. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

END OF SECTION 26 05 05

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SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single conductor building wire.

B. Metal-clad cable.

C. Manufactured wiring systems.

D. Wiring connectors.

E. Electrical tape.

F. Heat shrink tubing.

G. Wire pulling lubricant.

H. Cable ties.

I. Firestop sleeves.

1.2 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

1.3 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2024).

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2023.

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).

E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2024.

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F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2020.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

H. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable; 2018.

I. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.

J. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

M. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

N. UL 183 - Manufactured Wiring Systems; Current Edition, Including All Revisions.

O. UL 267 - Outline of Investigation for Wire-Pulling Compounds; Current Edition, Including All Revisions.

P. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

Q. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

R. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

S. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

T. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.

2. Coordinate the installation of direct burial cable with other trades to avoid conflicts with piping or other potential conflicts.

3. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.

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4. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

C. Manufactured Wiring System Shop Drawings: Provide plan views indicating proposed system layout with components identified; indicate branch circuit connections.

D. Field Quality Control Test Reports.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

G. Maintenance Materials: Furnish the following for CPL's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.

2. Extra Manufactured Wiring Systems Cable Assemblies: Two of each configuration, 6 feet length.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

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1.8 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Engineer and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.1 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

1. Exceptions:

a. Use manufactured wiring systems for branch circuits where concealed under raised floors.

1) Exception: Provide single conductor building wire in raceway for circuit homerun from distribution box to panelboard.

C. Nonmetallic-sheathed cable is not permitted.

D. Underground feeder and branch-circuit cable is not permitted.

E. Service entrance cable is not permitted.

F. Armored cable is not permitted.

G. Metal-clad cable is permitted only as follows:

1. Where not otherwise restricted, may be used:

a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.

1) Maximum Length: 6 feet.

b. Where concealed under raised floors for branch circuits up to 20 A.

1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.

2. In addition to other applicable restrictions, may not be used:

a. Unless approved by CPL.

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b. Where not approved for use by the authority having jurisdiction.

c. Where exposed to view.

d. Where exposed to damage.

e. For damp, wet, or corrosive locations.

H. Manufactured wiring systems are permitted only as follows:

1. Where not otherwise restricted, may be used:

a. For branch circuits where concealed under raised floors.

1) Exception: Provide single conductor building wire in raceway for circuit homerun from distribution box to panelboard.

2. In addition to other applicable restrictions, may not be used:

a. Where not approved for use by the authority having jurisdiction.

b. Where exposed to view.

c. Where exposed to damage.

d. For damp, wet, or corrosive locations.

2.2 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductors and Cables Installed Where Exposed to Direct Rays of Sun: Listed and labeled as sunlight resistant.

H. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.

I. Conductor Material:

1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.

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2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
3. Tinned Copper Conductors: Comply with ASTM B33.

J. Minimum Conductor Size:
1. Branch Circuits: 12 AWG.
a. Exceptions:
1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
2. Control Circuits: 14 AWG.

K. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

L. Conductor Color Coding:
1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
2. Color Coding Method: Integrally colored insulation.
a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
3. Color Code:
a. 208Y/120 V, 3 Phase, 4 Wire System:
1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.
4) Neutral/Grounded: White.
b. Equipment Ground, All Systems: Green.

2.3 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
1. Copper Building Wire:
a. Cerro Wire LLC: www.cerrowire.com/#sle.
b. Encore Wire Corporation: www.encorewire.com/#sle.

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c. General Cable Technologies Corporation; _____: www.generalcable.com/#sle.

d. Service Wire Co: www.servicewire.com/#sle.

e. Southwire Company: www.southwire.com/#sle.

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

B. Description: Single conductor insulated wire.

C. Conductor Stranding:

1. Feeders and Branch Circuits:

a. Size 10 AWG and Smaller: Solid or stranded.

b. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:

1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.

a. Size 4 AWG and Larger: Type XHHW-2.

b. Installed Underground: Type XHHW-2.

2.4 METAL-CLAD CABLE

A. Manufacturers:

1. AFC Cable Systems Inc: www.afcweb.com/#sle.

2. Encore Wire Corporation: www.encorewire.com/#sle.

3. Service Wire Co: www.servicewire.com/#sle.

4. Southwire Company: www.southwire.com/#sle.

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

B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:

1. Size 10 AWG and Smaller: Solid or stranded.

2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

F. Grounding: Full-size integral equipment grounding conductor.

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G. Armor: Aluminum or steel, interlocked tape.

2.5 MANUFACTURED WIRING SYSTEMS

A. Manufacturers:

1. AFC Cable Systems Inc: www.afcweb.com/#sle.
2. D&P Custom Lights & Wiring Systems, Inc: www.dandpcustomlights.com/#sle.
3. RELOC Wiring Solutions, a brand of Acuity Brands, Inc: www.relocwiring.com/#sle.
4. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/#sle.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: Manufactured wiring assemblies complying with NFPA 70 Article 604, and listed and labeled as complying with UL 183.

C. Provide manufactured wiring assemblies compatible with access floor system floorboxes as specified in 26 05 33.16 - Boxes for Electrical Systems and 26 05 33.16 - Boxes for Electrical Systems .

D. Provide components necessary to transition between manufactured wiring system and other wiring methods.

E. Branch Circuit Cables:

1. Conductor Stranding (Size 10 AWG and Smaller): Solid or stranded.
2. Insulation Voltage Rating: 600 V.
3. Insulation: Type THHN.
4. Grounding: Full-size integral equipment grounding conductor.
5. Armor: Steel, interlocked tape.

F. Connectors: Keyed and color-coded to prevent interconnection of different voltages.

G. Fixture Leads: Type TFN insulation.

2.6 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 26 05 26.

C. Wiring Connectors for Splices and Taps:

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1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

D. Wiring Connectors for Terminations:

1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
6. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
7. Conductors for Control Circuits: Use crimped terminals for all connections.

E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

1. Manufacturers:
    a. 3M: www.3m.com/#sle.
    b. Ideal Industries, Inc: www.idealindustries.com/#sle.
    c. NSI Industries LLC: www.nsiindustries.com/#sle.
    d. Substitutions: See Section 01 60 00 - Product Requirements.

H. Mechanical Connectors: Provide bolted type or set-screw type.

1. Manufacturers:
    a. Burndy LLC; _____: www.burndy.com/#sle.
    b. nVent ILSCO: www.ilsco.com/#sle.

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c. Thomas & Betts Corporation: www.tnb.com/#sle.

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

I. Compression Connectors: Provide circumferential type or hex type crimp configuration.

1. Manufacturers:

a. Burndy LLC; _____: www.burndy.com/#sle.

b. nVent ILSCO: www.ilsco.com/#sle.

c. Thomas & Betts Corporation: www.tnb.com/#sle.

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

J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

1. Manufacturers:

a. Burndy LLC; _____: www.burndy.com/#sle.

b. Ilsco: www.ilsco.com/#sle.

c. Thomas & Betts Corporation: www.tnb.com/#sle.

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

2.7 ACCESSORIES

A. Electrical Tape:

1. Manufacturers:

a. 3M: www.3m.com/#sle.

b. Plymouth Rubber Europa: www.plymouthrubber.com/#sle.

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

2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.

3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.

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4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
6. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil; suitable for continuous temperature environment up to 221 degrees F.
7. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      b. Burndy LLC; _____: www.burndy.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

C. Wire Pulling Lubricant:
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      b. American Polywater Corporation: www.polywater.com/#sle.
      c. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Listed and labeled as complying with UL 267.
   3. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
   4. Suitable for use at installation temperature.

D. Cable Ties: Material and tensile strength rating suitable for application.

E. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for cables and roofing system to be installed; designed to accommodate existing penetrations where applicable.
   1. Products:
      a. Menzies Metal Products; Electrical Roof Stack and Cap: www.menzies-metal.com/#sle.

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b. Menzies Metal Products; Electrical Retro Box: www.menzies-metal.com/#sle.

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

F. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

1. Products:

a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built: www.holdrite.com/#sle.

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

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.3 INSTALLATION

A. Circuiting Requirements:

1. Unless dimensioned, circuit routing indicated is diagrammatic.

2. When circuit destination is indicated without specific routing, determine exact routing required.

3. Arrange circuiting to minimize splices.

4. Include circuit lengths required to install connected devices within 10 ft of location indicated.

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5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is permitted, under the following conditions:
    a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
    b. Increase size of conductors as required to account for ampacity derating.
8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install metal-clad cable (Type MC) in accordance with NECA 120.

E. Installation in Raceway:
1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
2. Pull all conductors and cables together into raceway at same time.
3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

G. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.

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2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.

H. Terminate cables using suitable fittings.

1. Metal-Clad Cable (Type MC):

a. Use listed fittings.

b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

c. Do not use direct-bearing set-screw type fittings for cables with aluminum armor.

I. Install conductors with a minimum of 12 inches of slack at each outlet.

J. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

K. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

L. Make wiring connections using specified wiring connectors.

1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.

2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.

3. Do not remove conductor strands to facilitate insertion into connector.

4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.

5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

M. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.

a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.

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b. For taped connections likely to require re-entering, including motor leads, first apply varnished cambric electrical tape, followed by adequate amount of rubber splicing electrical tape, followed by outer covering of vinyl insulating electrical tape.

2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.

a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.

b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.

3. Wet Locations: Use heat shrink tubing.

N. Insulate ends of spare conductors using vinyl insulating electrical tape.

O. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

Q. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.4 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION 26 05 19

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SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

1.2 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

C. Section 26 56 00 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

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1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Field quality control test reports.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

B. Do not use products for applications other than as permitted by NFPA 70 and product listing.

C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

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E. Grounding System Resistance:

1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Engineer. Precipitation within the previous 48 hours does not constitute normally dry conditions.

F. Bonding and Equipment Grounding:

1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
    a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
8. Provide bonding for interior metal air ducts.

G. Communications Systems Grounding and Bonding:

1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
    a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
    b. Raceway Size: 3/4 inch trade size unless otherwise indicated or required.

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c. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.

d. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

H. Pole-Mounted Luminaires: Also comply with Section 26 56 00.

2.2 GROUNDING AND BONDING COMPONENTS

A. General Requirements:

1. Provide products listed, classified, and labeled as suitable for the purpose intended.

2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 05 26:

1. Use insulated copper conductors unless otherwise indicated.

a. Exceptions:

1) Use bare copper conductors where installed underground in direct contact with earth.

2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:

1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.

2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.

3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

4. Manufacturers - Mechanical and Compression Connectors:

a. allG Fabrication; _____: www.allgfab.com/#sle.

b. Burndy LLC; _____: www.burndy.com/#sle.

c. Harger Lightning & Grounding; _____: www.harger.com/#sle.

d. nVent ERICO; _____: www.nvent.com/#sle.

e. Thomas & Betts Corporation; _____: www.tnb.com/#sle.

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

5. Manufacturers - Exothermic Welded Connections:

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a. Burndy LLC; _____: www.burndy.com/#sle.

b. nVent ERICO; Cadweld: www.nvent.com/#sle.

c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC; _____: www.thermoweld.com/#sle.

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

D. Ground Bars:

1. Description: Copper rectangular ground bars with mounting brackets and insulators.

2. Size: As indicated.

3. Holes for Connections: As indicated or as required for connections to be made.

4. Manufacturers:

a. allG Fabrication; _____: www.allgfab.com/#sle.

b. Harger Lightning & Grounding; _____: www.harger.com/#sle.

c. nVent ERICO; _____: www.nvent.com/#sle.

d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC; _____: www.thermoweld.com/#sle.

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

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

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

B. Perform work in accordance with NECA 1 (general workmanship).

C. Make grounding and bonding connections using specified connectors.

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1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

D. Identify grounding and bonding system components in accordance with Section 26 05 53.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.13.

D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION 26 05 26

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SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 05 50 00 - Metal Fabrications: Materials and requirements for fabricated metal supports.

C. Section 26 05 33.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

D. Section 26 05 33.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

E. Section 26 51 00 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

F. Section 26 56 00 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.3 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

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G. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
2. Coordinate work to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
5. Notify Engineer of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has cured; see Section 03 30 00.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

D. Derating Calculations for Fiberglass Channel/Strut Framing Systems: Indicate load ratings adjusted for applicable service conditions.

E. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.

F. Installer's qualification statement.

G. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

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1.6 QUALITY ASSURANCE

A. Maintain at project site one copy of each referenced document that prescribes execution requirements.

B. Installer Qualifications for Field Welding: See Section 05 50 00.

C. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Comply with the following. Where requirements differ, comply with most stringent.
    a. NFPA 70.
    b. Requirements of authorities having jurisdiction.
2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for load to be supported with minimum safety factor of _____. Include consideration for vibration, equipment operation, and shock loads where applicable.
5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
6. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
7. Steel Components: Use corrosion-resistant materials suitable for environment where installed.

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a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.

b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.

c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.

d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.

1. Manufacturers:

a. ABB: www.electrification.us.abb.com/#sle.

b. Eaton Corporation: www.eaton.com/#sle.

c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.

d. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.

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

2. Conduit Straps: One-hole or two-hole type; steel or malleable iron.

3. Conduit Clamps: Bolted type unless otherwise indicated.

4. Products:

a. Gripple, Inc; Universal Bracket: www.gripple.com/#sle.

b. Gripple, Inc; Fast Trak: www.gripple.com/#sle.

c. Gripple, Inc; Universal Clamp (Threaded): www.gripple.com/#sle.

d. Gripple, Inc; Low Profile Bracket Kits: www.gripple.com/#sle.

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

C. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.

1. Manufacturers:

a. ABB: www.electrification.us.abb.com/#sle.

b. Eaton Corporation: www.eaton.com/#sle.

c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.

d. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.

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

D. Metal Channel/Strut Framing Systems:

1. Manufacturers:

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a. ABB: www.electrification.us.abb.com/#sle.

b. Atkore International Inc; Unistrut: www.unistrut.us/#sle.

c. Custom Strut and Roll Forming, LLC; _____: www.customstrut.com/#sle.

d. Eaton Corporation: www.eaton.com/#sle.

e. Elgen Manufacturing Company, Inc; _____: www.elgenmfg.com/#sle.

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

g. Source Limitations: Furnish channel/strut and associated fittings, accessories, and hardware produced by single manufacturer.

2. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.

3. Comply with MFMA-4.

4. Channel/Strut Used as Raceway, Where Indicated: Listed and labeled as complying with UL 5B.

5. Channel Material:

a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.

b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.

6. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.

7. Minimum Channel Dimensions: 1-5/8 inch wide by 13/16 inch high.

E. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.

1. Minimum Size, Unless Otherwise Indicated or Required:

a. Busway Supports: 1/2-inch diameter.

b. Single Conduit up to 1-inch (27 mm) Trade Size: 1/4-inch diameter.

c. Single Conduit Larger than 1-inch (27 mm) Trade Size: 3/8-inch diameter.

d. Trapeze Support for Multiple Conduits: 3/8-inch diameter.

e. Outlet Boxes: 1/4-inch diameter.

f. Luminaires: 1/4-inch diameter.

F. Nonpenetrating Rooftop Supports for Low-Slope Roofs:

1. Manufacturers:

a. Atkore International Inc; Unistrut: www.unistrut.us/#sle.

b. Eaton Corporation: www.eaton.com/#sle.

c. Green Link, Inc: www.greenlinkengineering.com/#sle.

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d. PHP Systems/Design: www.phpsd.com/#sle.

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

2. Description: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring attachment to roof structure and not penetrating roofing assembly, with support fixtures as specified.

3. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.

4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.

5. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

G. Anchors and Fasteners:

1. Manufacturers - Mechanical Anchors:

a. Dewalt: anchors.dewalt.com/#sle.

b. Hilti, Inc: www.hilti.com/#sle.

c. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com/#sle.

d. MKT Fastening: www.mktfasteningusa.com/#sle.

e. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.

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

2. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.

3. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.

4. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.

5. Hollow Masonry: Use toggle bolts.

6. Hollow Stud Walls: Use toggle bolts.

7. Steel: Use beam clamps, machine bolts, or welded threaded studs.

8. Sheet Metal: Use sheet metal screws.

9. Plastic and lead anchors are not permitted.

10. Powder-actuated fasteners are not permitted.

11. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.

a. Manufacturer: Same as manufacturer of metal channel/strut framing system.

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b. Comply with MFMA-4.

c. Channel Material: Use galvanized steel.

d. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch minimum base metal thickness.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

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

B. Install hangers and supports in accordance with NECA 1.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Engineer, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Engineer, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:

1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.

2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.

3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.

4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Conduit Support and Attachment: See Section 26 05 33.13 for additional requirements.

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I. Box Support and Attachment: See Section 26 05 33.16 for additional requirements.

J. Interior Luminaire Support and Attachment: See Section 26 51 00 for additional requirements.

K. Exterior Luminaire Support and Attachment: See Section 26 56 00 for additional requirements.

L. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

M. Secure fasteners in accordance with manufacturer's recommended torque settings.

N. Remove temporary supports.

O. Identify independent electrical component support wires above accessible ceilings, where permitted, with color distinguishable from ceiling support wires in accordance with NFPA 70.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 26 05 29

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SECTION 26 05 33.13 - CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Galvanized steel intermediate metal conduit (IMC).

C. PVC-coated galvanized steel rigid metal conduit (RMC).

D. Flexible metal conduit (FMC).

E. Galvanized steel electrical metallic tubing (EMT).

F. Rigid polyvinyl chloride (PVC) conduit.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete encasement of conduits.

B. Section 07 84 00 - Firestopping.

C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

1. Includes additional requirements for fittings for grounding and bonding.

D. Section 26 05 29 - Hangers and Supports for Electrical Systems.

E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

F. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.

1.3 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.

C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2018.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.

F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2025.

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G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

H. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit; 2018.

I. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.

J. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

M. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

N. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

O. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

P. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

Q. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

R. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

S. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.

2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.

3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.

4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.

5. Notify Engineer of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

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1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

C. Shop Drawings:

1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.

2. Include proposed locations of roof penetrations and proposed methods for sealing.

D. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2-inch (53 mm) trade size and larger.

1.6 QUALITY ASSURANCE

A. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.

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C. Underground:

1. Under Slab on Grade: Use PVC-coated galvanized steel rigid metal conduit (RMC) or rigid PVC conduit.

2. Exterior, Direct-Buried: Use PVC-coated galvanized steel rigid metal conduit or rigid PVC conduit.

3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), or rigid PVC conduit.

4. Where rigid polyvinyl chloride (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or schedule 80 rigid PVC conduit where emerging from underground.

5. Where rigid polyvinyl (PVC) conduit larger than 2-inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit (RMC) elbows, galvanized steel intermediate metal conduit (IMC) elbows, PVC-coated galvanized steel rigid metal conduit (RMC) elbows, or concrete-encased PVC elbows for bends.

6. Where galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC) is installed in direct contact with earth where soil has resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection.

7. Where galvanized rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC), emerges from concrete into soil, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection for minimum of 4 inches on either side of where conduit emerges.

D. Embedded Within Concrete:

1. Within Slab on Grade: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or rigid PVC conduit. Embed within structural slabs only where approved by Structural Engineer.

2. Within Slab Above Ground: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or rigid PVC conduit. Embed within structural slabs only where approved by Structural Engineer.

E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC).

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F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT).

G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT).

H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC).

I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT).

J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC).

    1. Locations subject to physical damage include, but are not limited to:

        a. Where exposed below 8 feet, except within electrical and communication rooms or closets.

K. Exposed, Exterior, Not Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC).

L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT).

M. Flexible Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit (FMC).

    1. Maximum Length: 6 feet.

N. Flexible Connections to Vibrating Equipment:

    1. Dry Locations: Use flexible metal conduit (FMC).

    2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible non-metallic conduit.

    3. Maximum Length: 6 feet unless otherwise indicated.

    4. Vibrating equipment includes, but is not limited to:

        a. Motors.

O. Fished in Existing Walls, Where Necessary: Use flexible metal conduit (FMC) or galvanized steel electrical metallic tubing (EMT).

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2.2 CONDUIT - GENERAL REQUIREMENTS

A. Comply with NFPA 70.

B. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling mandrel through them.

C. Fittings for Grounding and Bonding: See Section 26 05 26 for additional requirements.

D. Provide conduit, fittings, supports, and accessories required for complete raceway system.

E. Provide products listed, classified, and labeled as suitable for purpose intended.

F. Minimum Conduit Size, Unless Otherwise Indicated:

1. Branch Circuits: 3/4-inch trade size.
2. Branch Circuit Homeruns: 3/4-inch trade size.
3. Control Circuits: 3/4-inch trade size.
4. Flexible Connections to Luminaires: 3/8-inch trade size.
5. Underground, Interior: 3/4-inch trade size.
6. Underground, Exterior: 1-inch trade size.

G. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:

1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
2. Nucor Tubular Products: www.nucortubular.com/#sle.
3. Rymco USA: www.rymcousa.com/#sle.
4. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
5. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Factory-Painted, Color-Coded Galvanized Steel RMC: Apply according to indicated color code.

1. See Section 26 05 53 for color code.

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D. Fittings:

1. Manufacturers:

a. ABB; T&B: www.electrification.us.abb.com/#sle.

b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.

c. Bridgeport Fittings Inc: www.bptfittings.com/#sle.

d. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.

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

2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.

3. Material: Use steel or malleable iron.

a. Do not use die cast zinc fittings.

4. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.4 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:

1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.

2. Nucor Tubular Products: www.nucortubular.com/#sle.

3. Rymco USA: www.rymcousa.com/#sle.

4. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.

B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

C. Fittings:

1. Manufacturers:

a. ABB; T&B: www.electrification.us.abb.com/#sle.

b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.

c. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.

d. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.

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

2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.

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3. Material: Use steel or malleable iron.
    a. Do not use die cast zinc fittings.
4. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.5 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
    1. ABB; Ocal: www.electrification.us.abb.com/#sle.
    2. Calbond, a division of Atkore International www.calbond.com/#sle
    3. Robroy Industries: www.robroy.com/#sle.
    4. Substitutions: See Section 01 60 00 - Product Requirements.
B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.
C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil, 0.040 inch.
D. Interior Coating: Urethane, minimum thickness of 2 mil, 0.002 inch.
E. PVC-Coated Boxes and Fittings:
    1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
    2. Nonhazardous Locations: Use boxes and fittings listed and labeled as complying with UL 514A, UL 514B, or UL 6.
    3. Material: Use steel or malleable iron.
    4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil, 0.040 inch.
    5. Interior Coating: Urethane, minimum thickness of 2 mil, 0.002 inch.
F. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil, 0.015 inch.

2.6 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
    1. AFC Cable Systems, a division of Atkore International: www.afcweb.com/#sle.
    2. Electri-Flex Company: www.electriflex.com/#sle.
    3. International Metal Hose: www.metalhose.com/#sle.

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

B. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.

C. Fittings:

1. Manufacturers:

a. ABB; T&B: www.electrification.us.abb.com/#sle.

b. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.

c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.

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

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

3. Material: Use steel or malleable iron.

a. Do not use die cast zinc fittings.

2.7 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.

2. Nucor Tubular Products: www.nucortubular/#sle.

3. Rymco USA: www.rymcousa.com/#sle.

4. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.

5. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.

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

B. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Factory-Painted, Color-Coded Galvanized Steel EMT: Apply according to indicated color code.

1. See Section 26 05 53 for color code.

D. Fittings:

1. Manufacturers:

a. ABB; T&B: www.electrification.us.abb.com/#sle.

b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.

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c. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.

d. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

3. Material: Use steel or malleable iron.

a. Do not use die cast zinc fittings.

4. Connectors and Couplings: Use compression/gland or set-screw type.

a. Do not use indenter type connectors and couplings.

5. Damp or Wet Locations, Where Permitted: Use fittings listed for use in wet locations.

2.8 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:

1. ABB; Carlon: www.carlon.com/#sle.

2. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.

3. Cantex Inc: www.cantexinc.com/#sle.

4. Heritage Plastics, a division of Atkore International: www.heritageplastics.com/#sle.

5. JM Eagle: www.jmeagle.com/#sle.

6. Rymco USA: www.rymcousa.com/#sle.

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

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:

1. Manufacturer: Same as manufacturer of conduit to be connected.

2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.9 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch.

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B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf.

E. Foam Conduit Sealant:

1. Removable, two-part, closed-cell foam, specifically designed for sealing conduit openings against water, moisture, gases, and dust.
2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
3. Rated to hold minimum of 10 ft water head pressure.

F. Conduit Mechanical Seals:

1. Listed as complying with UL 514B.
2. Specifically designed for sealing conduit openings against water, moisture, gases, and dust.
3. Suitable for sealing around conductors/cables to be installed.

G. Sealing Systems for Concrete Penetrations:

1. Sleeves: Provide water stop ring or cement coating that bonds to concrete to prevent water infiltration.
2. Rate for minimum of 40 psig; suitable for sealing around conduits to be installed.

H. Sealing Systems for Roof Penetrations: 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.

I. 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.

J. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

K. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for conduit/duct arrangement to be installed.

L. Bore Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for installation within casing; furnished with roller wheels to facilitate installation, openings to facilitate grout

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flow, and holes for stabilization cable; suitable for casing and conduit/duct arrangement to be installed.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

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

B. Install conduit in accordance with NECA 1.

C. Galvanized Steel Rigid Metal Conduit (RMC): Install in accordance with NECA 101.

D. Intermediate Metal Conduit (IMC): Install in accordance with NECA 101.

E. PVC-Coated Galvanized Steel Rigid Metal Conduit (RMC): Install using only tools approved by manufacturer.

F. Rigid Polyvinyl Chloride (PVC) Conduit: Install in accordance with NECA 111.

G. Conduit Routing:

1. Unless dimensioned, conduit routing indicated is diagrammatic.
2. When conduit destination is indicated without specific routing, determine exact routing required.
3. Conceal conduits unless specifically indicated to be exposed.
4. Conduits in the following areas may be exposed, unless otherwise indicated:
    a. Electrical rooms.
    b. Mechanical equipment rooms.
    c. Within joists in areas with no ceiling.
5. Unless otherwise approved, do not route exposed conduits:
    a. Across floors.
    b. Across top of parapet walls.

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c. Across building exterior surfaces.

6. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
7. Arrange conduit to maintain adequate headroom, clearances, and access.
8. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.
9. Arrange conduit to provide no more than 150 feet between pull points.
10. Route conduits above water and drain piping where possible.
11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
    a. Heaters.
    b. Hot water piping.
    c. Flues.
14. Group parallel conduits in same area on common rack.

H. Conduit Support:

1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 26 05 29.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
4. Use conduit strap to support single surface-mounted conduit.
    a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
5. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
6. Use conduit clamp to support single conduit from beam clamp or threaded rod.

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7. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
8. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.
9. Use of spring steel conduit clips for support of conduits is not permitted.
10. Use of wire for support of conduits is not permitted.
11. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with most stringent requirements.

I. Connections and Terminations:

1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
5. Where spare conduits stub up through concrete floors and are not terminated in box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
6. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
7. Secure joints and connections to provide mechanical strength and electrical continuity.

J. Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Provide suitable sealing system where conduits penetrate exterior wall below grade.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.

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7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
8. Provide metal escutcheon plates for conduit penetrations exposed to public view.
9. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 07 84 00.

K. Underground Installation:

1. Provide trenching and backfilling; see Section 31 23 16.13.
2. Minimum Cover, Unless Otherwise Indicated or Required:
   a. Underground, Exterior: 18 inches.
   b. Under Slab on Grade: 12 inches to bottom of slab.
3. Provide underground warning tape along entire conduit length for service entrance where not concrete-encased; see Section 26 05 53.

L. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):

1. Maximum Conduit Size: 1-inch trade size unless otherwise approved.
2. Install conduits within middle one third of slab thickness.
3. Secure conduits to prevent floating or movement during pouring of concrete.

M. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide minimum concrete cover of 3 inches on all sides unless otherwise indicated; see Section 03 30 00.

N. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:

1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
3. Where conduits are subject to earth movement by settlement or frost.

O. Conduit Sealing:

1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
   a. Where conduits enter building from outside.
   b. Where service conduits enter building from underground distribution system.

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c. Where conduits enter building from underground.

d. Where conduits may transport moisture to contact live parts.

2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:

a. Where conduits pass from outdoors into conditioned interior spaces.

b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

c. Where conduits penetrate coolers or freezers.

P. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

Q. Provide grounding and bonding; see Section 26 05 26.

R. Identify conduits; see Section 26 05 53.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

D. Correct deficiencies and replace damaged or defective conduits.

3.4 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.5 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION 26 05 33.13

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SECTION 26 05 33.16 - BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Boxes and enclosures for integrated power, data, and audio/video.

D. Floor boxes.

E. Underground boxes/enclosures.

F. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 08 31 00 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

C. Section 26 05 29 - Hangers and Supports for Electrical Systems.

D. Section 26 05 33.13 - Conduit for Electrical Systems:

1. Conduit bodies and other fittings.
2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26 27 26 - Wiring Devices:

1. Wall plates.
2. Floor box service fittings.
3. Additional requirements for locating boxes for wiring devices.

G. Section 27 10 00 - Structured Cabling: Additional requirements for communications systems outlet boxes.

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1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).

F. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; 2013 (Reaffirmed 2020).

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. SCTE 77 - Specifications for Underground Enclosure Integrity; 2023.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

K. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

L. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

M. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.

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4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

1. Underground Boxes/Enclosures: Include reports for load testing in accordance with SCTE 77 certified by a professional engineer or an independent testing agency upon request.

C. Samples:

1. Floor Boxes: Provide one sample(s) of each specified floor box upon request.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

F. Maintenance Materials: Furnish the following for CPL's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Keys for Lockable Enclosures: Two of each different key.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

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C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 BOXES

A. General Requirements:

1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:

1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
4. Use nonmetallic boxes where exposed rigid PVC conduit is used.
5. Use suitable concrete type boxes where flush-mounted in concrete.
6. Use suitable masonry type boxes where flush-mounted in masonry walls.
7. Use raised covers suitable for the type of wall construction and device configuration where required.

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8. Use shallow boxes where required by the type of wall construction.
9. Do not use "through-wall" boxes designed for access from both sides of wall.
10. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
11. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
12. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
13. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
14. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
15. Minimum Box Size, Unless Otherwise Indicated:
    a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
    b. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
16. Wall Plates: Comply with Section 26 27 26.
17. Manufacturers:
    a. Cooper Crouse-Hinds, a division of Eaton Corporation; _____: www.cooperindustries.com/#sle.
    b. Hubbell Incorporated; Bell Products; _____: www.hubbell-rtb.com/#sle.
    c. O-Z/Gedney, a brand of Emerson Electric Co; _____: www.emerson.com/#sle.
    d. Substitutions: See Section 01 60 00 - Product Requirements.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA EN 10250 Environment Type, Unless Otherwise Indicated:
    a. Indoor Clean, Dry Locations: Type 1, painted steel.
    b. Outdoor Locations: Type 3R, painted steel.
3. Junction and Pull Boxes Larger Than 100 cubic inches:

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a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

b. Boxes 6 square feet and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.

4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:

a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.

b. Back Panels: Painted steel, removable.

c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.

5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.

6. Manufacturers:

a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.

b. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com/#sle.

c. Hubbell Incorporated; Wiegmann Products: www.hubbell-wiegmann.com/#sle.

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

D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may not be used.

1. Manufacturers:

a. Legrand AV Chief PAC525.

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

E. Floor Boxes:

1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26 27 26; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.

2. Use cast iron floor boxes within slab on grade.

3. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).

4. Manufacturer: Same as manufacturer of floor box service fittings.

F. Underground Boxes/Enclosures:

1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.

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2. Size: As indicated on drawings.
3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches.
4. Applications:
    a. Sidewalks and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 8 load rating.
    b. Parking Lots, in Areas Subject Only To Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 15 load rating.
    c. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.
5. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
    a. Manufacturers:
    b. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.

2.2 ACCESSORIES

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for boxes and facade materials to be installed.
    1. Manufacturers:
        a. Quickflash Weatherproofing Products, Inc: www.quickflashproducts.com/#sle.
        b. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

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

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B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. Box Locations:

1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 31 00 as required where approved by the Architect.

2. Unless dimensioned, box locations indicated are approximate.

3. Locate boxes as required for devices installed under other sections or by others.

   a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 27 26.

   b. Communications Systems Outlets: Comply with Section 27 10 00.

4. Locate boxes so that wall plates do not span different building finishes.

5. Locate boxes so that wall plates do not cross masonry joints.

6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.

7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.

8. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.

   a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.

   b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.

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9. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 05 33.13.
10. Locate junction and pull boxes in the following areas, unless otherwise indicated:
    a. Concealed above accessible suspended ceilings.
    b. Within joists in areas with no ceiling.
    c. Electrical rooms.
    d. Mechanical equipment rooms.

I. Box Supports:

1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.

J. Install boxes plumb and level.

K. Flush-Mounted Boxes:

1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

L. Install boxes as required to preserve insulation integrity.

M. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

N. Underground Boxes/Enclosures:

1. Install enclosure on gravel base, minimum 6 inches deep.

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2. Flush-mount enclosures located in concrete or paved areas.
3. Mount enclosures located in landscaped areas with top at 1 inch above finished grade.
4. Provide cast-in-place concrete collar constructed in accordance with Section 03 30 00, minimum 10 inches wide by 12 inches deep, around enclosures that are not located in concrete areas.
5. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

O. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

Q. Close unused box openings.

R. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

S. Provide grounding and bonding in accordance with Section 26 05 26.

T. Identify boxes in accordance with Section 26 05 53.

3.3 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.4 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION 26 05 33.16

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SECTION 26 05 33.16 - BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Boxes and enclosures for integrated power, data, and audio/video.

D. Floor boxes.

E. Underground boxes/enclosures.

F. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 08 31 00 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

C. Section 26 05 29 - Hangers and Supports for Electrical Systems.

D. Section 26 05 33.13 - Conduit for Electrical Systems:

1. Conduit bodies and other fittings.
2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26 27 26 - Wiring Devices:

1. Wall plates.
2. Floor box service fittings.
3. Additional requirements for locating boxes for wiring devices.

G. Section 27 10 00 - Structured Cabling: Additional requirements for communications systems outlet boxes.

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1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).

F. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; 2013 (Reaffirmed 2020).

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. SCTE 77 - Specifications for Underground Enclosure Integrity; 2023.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

K. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

L. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

M. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.

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4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

1. Underground Boxes/Enclosures: Include reports for load testing in accordance with SCTE 77 certified by a professional engineer or an independent testing agency upon request.

C. Samples:

1. Floor Boxes: Provide one sample(s) of each specified floor box upon request.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

F. Maintenance Materials: Furnish the following for CPL's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Keys for Lockable Enclosures: Two of each different key.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

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C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 BOXES

A. General Requirements:

1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:

1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
4. Use nonmetallic boxes where exposed rigid PVC conduit is used.
5. Use suitable concrete type boxes where flush-mounted in concrete.
6. Use suitable masonry type boxes where flush-mounted in masonry walls.
7. Use raised covers suitable for the type of wall construction and device configuration where required.

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8. Use shallow boxes where required by the type of wall construction.
9. Do not use "through-wall" boxes designed for access from both sides of wall.
10. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
11. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
12. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
13. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
14. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
15. Minimum Box Size, Unless Otherwise Indicated:
    a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
    b. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
16. Wall Plates: Comply with Section 26 27 26.
17. Manufacturers:
    a. Cooper Crouse-Hinds, a division of Eaton Corporation; _____: www.cooperindustries.com/#sle.
    b. Hubbell Incorporated; Bell Products; _____: www.hubbell-rtb.com/#sle.
    c. O-Z/Gedney, a brand of Emerson Electric Co; _____: www.emerson.com/#sle.
    d. Substitutions: See Section 01 60 00 - Product Requirements.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA EN 10250 Environment Type, Unless Otherwise Indicated:
    a. Indoor Clean, Dry Locations: Type 1, painted steel.
    b. Outdoor Locations: Type 3R, painted steel.
3. Junction and Pull Boxes Larger Than 100 cubic inches:

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a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

b. Boxes 6 square feet and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.

4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:

a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.

b. Back Panels: Painted steel, removable.

c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.

5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.

6. Manufacturers:

a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.

b. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com/#sle.

c. Hubbell Incorporated; Wiegmann Products: www.hubbell-wiegmann.com/#sle.

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

D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may not be used.

1. Manufacturers:

a. Legrand AV Chief PAC525.

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

E. Floor Boxes:

1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26 27 26; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.

2. Use cast iron floor boxes within slab on grade.

3. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).

4. Manufacturer: Same as manufacturer of floor box service fittings.

F. Underground Boxes/Enclosures:

1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.

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2. Size: As indicated on drawings.
3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches.
4. Applications:
    a. Sidewalks and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 8 load rating.
    b. Parking Lots, in Areas Subject Only To Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 15 load rating.
    c. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.
5. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
    a. Manufacturers:
    b. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.

2.2 ACCESSORIES

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for boxes and facade materials to be installed.
    1. Manufacturers:
        a. Quickflash Weatherproofing Products, Inc: www.quickflashproducts.com/#sle.
        b. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

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

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B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. Box Locations:

1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 31 00 as required where approved by the Architect.

2. Unless dimensioned, box locations indicated are approximate.

3. Locate boxes as required for devices installed under other sections or by others.

   a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 27 26.

   b. Communications Systems Outlets: Comply with Section 27 10 00.

4. Locate boxes so that wall plates do not span different building finishes.

5. Locate boxes so that wall plates do not cross masonry joints.

6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.

7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.

8. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.

   a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.

   b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.

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9. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 05 33.13.
10. Locate junction and pull boxes in the following areas, unless otherwise indicated:
    a. Concealed above accessible suspended ceilings.
    b. Within joists in areas with no ceiling.
    c. Electrical rooms.
    d. Mechanical equipment rooms.

I. Box Supports:

1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.

J. Install boxes plumb and level.

K. Flush-Mounted Boxes:

1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

L. Install boxes as required to preserve insulation integrity.

M. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

N. Underground Boxes/Enclosures:

1. Install enclosure on gravel base, minimum 6 inches deep.

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2. Flush-mount enclosures located in concrete or paved areas.
3. Mount enclosures located in landscaped areas with top at 1 inch above finished grade.
4. Provide cast-in-place concrete collar constructed in accordance with Section 03 30 00, minimum 10 inches wide by 12 inches deep, around enclosures that are not located in concrete areas.
5. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

O. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

Q. Close unused box openings.

R. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

S. Provide grounding and bonding in accordance with Section 26 05 26.

T. Identify boxes in accordance with Section 26 05 53.

3.3 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.4 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION 26 05 33.16

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SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Underground warning tape.

F. Floor marking tape.

G. Warning signs and labels.

1.2 RELATED REQUIREMENTS

A. Section 09 91 13 - Exterior Painting.

B. Section 09 91 23 - Interior Painting.

C. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

D. Section 27 10 00 - Structured Cabling: Identification for communications cabling and devices.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.

C. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

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B. Sequencing:

1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.

2. Do not install identification products until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.7 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.1 IDENTIFICATION REQUIREMENTS

A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.

B. Identification for Equipment:

1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.

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a. Panelboards:

1) Identify ampere rating.

2) Identify voltage and phase.

3) Identify power source and circuit number. Include location.

4) Identify main overcurrent protective device. Use identification nameplate for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.

5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.

6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

b. Enclosed switches, circuit breakers, and motor controllers:

1) Identify voltage and phase.

2) Identify power source and circuit number. Include location.

3) Identify load(s) served. Include location.

c. Time Switches:

1) Identify load(s) served and associated circuits controlled. Include location.

d. Transfer Switches:

1) Identify voltage and phase.

2) Identify power source and circuit number for both normal power source and standby power source. Include location.

3) Identify load(s) served. Include location.

4) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.

e. Electricity Meters:

1) Identify load(s) metered.

2. Service Equipment:

a. Use identification nameplate to identify each service disconnecting means.

3. Use voltage marker to identify highest voltage present for each piece of electrical equipment.

4. Use identification nameplate to identify equipment utilizing series ratings, where permitted, in accordance with NFPA 70.

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5. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
6. Use identification nameplate at each fused switch to identify required NEMA fuse class and size.
7. Use identification nameplate at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.
8. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
9. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.
    a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches wide, painted in accordance with Section 09 91 23 and 09 91 13.
10. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
    a. Service equipment.
    b. Industrial control panels.
    c. Motor control centers.
    d. Elevator control panels.
    e. Industrial machinery.
11. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
    a. Minimum Size: 3.5 by 5 inches.
    b. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements".
    c. Service Equipment: Include the following information in accordance with NFPA 70.
        1) Nominal system voltage.
        2) Available fault current.

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3) Clearing time of service overcurrent protective device(s).

4) Date label applied.

12. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only".

C. Identification for Conductors and Cables:

1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.

2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment.

3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:

a. At each source and load connection.

b. Within boxes when more than one circuit is present.

c. Within equipment enclosures when conductors and cables enter or leave the enclosure.

4. Use underground warning tape to identify direct buried cables.

D. Identification for Raceways:

1. Use factory-painted conduits to identify systems other than normal power system for accessible conduits.

a. Color Code:

1) Fire Alarm System: Red.

2. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.

3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.

4. Use underground warning tape to identify underground raceways.

E. Identification for Boxes:

1. Use voltage markers to identify highest voltage present.

2. Use voltage markers or color coded boxes to identify systems other than normal power system.

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a. Color-Coded Boxes: Field-painted in accordance with Section 09 91 23 and 09 91 13 per the same color code used for raceways.

3. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.

a. For exposed boxes in public areas, use only identification labels.

F. Identification for Devices:

1. Identification for Communications Devices: Comply with Section 27 10 00.

2. Use identification label to identify fire alarm system devices.

3. Use identification label to identify serving branch circuit for all receptacles.

a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.

4. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.

G. Identification for Luminaires:

1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

2.2 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:

1. Manufacturers:

a. Brimar Industries, Inc: www.brimar.com/#sle.

b. Kolbi Pipe Marker Co; _____: www.kolbipipemarkers.com/#sle.

c. Seton Identification Products; _____: www.seton.com/#sle.

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

2. Materials:

a. Indoor Clean, Dry Locations: Use plastic nameplates.

b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.

3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.

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a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.

4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.

5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.

6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:

1. Manufacturers:

a. Brady Corporation; _____: www.bradyid.com/#sle.

b. Brother International Corporation: www.brother-usa.com/#sle.

c. Panduit Corp: www.panduit.com/#sle.

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

2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.

a. Use only for indoor locations.

3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:

1. Minimum Size: 1 inch by 2.5 inches.

2. Legend:

a. Equipment designation or other approved description.

b. Other information as indicated.

3. Text: All capitalized unless otherwise indicated.

4. Minimum Text Height:

a. System Designation: 1 inch.

b. Equipment Designation: 1/2 inch.

c. Other Information: 1/4 inch.

5. Color:

a. Normal Power System: White text on black background.

b. Stand-By System: White text on orange background.

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D. Format for Caution and Warning Messages:

1. Minimum Size: 2 inches by 4 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/2 inch.
5. Color: Black text on yellow background unless otherwise indicated.

E. Format for Receptacle Identification:

1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Power source and circuit number or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

F. Format for Control Device Identification:

1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Load controlled or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

G. Format for Fire Alarm Device Identification:

1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Designation indicated and device zone or address.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Red text on white background.

2.3 WIRE AND CABLE MARKERS

A. Manufacturers:

1. Brady Corporation; _____: www.bradyid.com/#sle.
2. HellermannTyton; _____: www.hellermanntyton.com/#sle.

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3. Panduit Corp: www.panduit.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

D. Legend: Power source and circuit number or other designation indicated.

E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

1. Do not use handwritten text.

F. Minimum Text Height: 1/8 inch.

G. Color: Black text on white background unless otherwise indicated.

2.4 VOLTAGE MARKERS

A. Manufacturers:

1. Brady Corporation; _____: www.bradyid.com/#sle.
2. Brimar Industries, Inc: www.brimar.com/#sle.
3. Seton Identification Products; _____: www.seton.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

C. Minimum Size:

1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
2. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
3. Markers for Junction Boxes: 1/2 by 2 1/4 inches.

D. Legend:

1. Markers for Voltage Identification: Highest voltage present.
2. Markers for System Identification:

E. Color: Black text on orange background unless otherwise indicated.

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2.5 UNDERGROUND WARNING TAPE

A. Manufacturers:

1. Brady Corporation; _____: www.bradyid.com/#sle.
2. Brimar Industries, Inc: www.brimar.com/#sle.
3. Seton Identification Products; _____: www.seton.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Materials: Use foil-backed detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

C. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.

D. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.

E. Legend: Type of service, continuously repeated over full length of tape.

F. Color:

1. Tape for Buried Power Lines: Black text on red background.
2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.6 FLOOR MARKING TAPE

A. Manufacturers:

1. Brady Corporation; _____: www.bradyid.com/#sle.
2. Brimar Industries, Inc: www.brimar.com/#sle.
3. Insite Solutions, LLC; _____: www.stop-painting.com/#sle.
4. Seton Identification Products; _____: www.seton.com/#sle.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlaminate, 3 inches wide, with alternating black and white stripes.

2.7 WARNING SIGNS AND LABELS

A. Manufacturers:

1. Brimar Industries, Inc: www.brimar.com/#sle.

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2. Clarion Safety Systems, LLC; _____: www.clarionsafety.com/#sle.
3. Insite Solutions, LLC; _____: www.stop-painting.com/#sle.
4. Seton Identification Products; _____: www.seton.com/#sle.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

C. Warning Signs:

1. Materials:
   a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic signs.
   b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
3. Minimum Size: 7 by 10 inches unless otherwise indicated.

D. Warning Labels:

1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
   a. Do not use labels designed to be completed using handwritten text.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.2 INSTALLATION

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

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:

1. Surface-Mounted Equipment: Enclosure front.
2. Flush-Mounted Equipment: Inside of equipment door.

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3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Branch Devices: Adjacent to device.
6. Interior Components: Legible from the point of access.
7. Conduits: Legible from the floor.
8. Boxes: Outside face of cover.
9. Conductors and Cables: Legible from the point of access.
10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.

G. Secure rigid signs using stainless steel screws.

H. Mark all handwritten text, where permitted, to be neat and legible.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION 26 05 53

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SECTION 26 05 73 - POWER SYSTEM STUDIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Short-circuit study.

B. Arc flash and shock risk assessment.

1. Includes arc flash hazard warning labels.

C. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.2 RELATED REQUIREMENTS

A. Section 26 05 53 - Identification for Electrical Systems: Additional requirements for arc flash hazard warning labels.

1.3 REFERENCE STANDARDS

A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2023.

B. IEEE 141 - IEEE Recommended Practice for Electric Power Distribution for Industrial Plants; 1993 (Reaffirmed 1999).

C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems; 2001, with Errata (2003).

D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis; 1997.

E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems; 2006.

F. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations; 2018, with Errata (2019).

G. NEMA MG 00001 - Motors and Generators; 2024.

H. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

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J. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Existing Installations: Coordinate with equipment manufacturer(s) to obtain data necessary for completion of studies.
2. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
3. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Submit study reports prior to or concurrent with product submittals.
2. Do not order equipment until matching study reports and product submittals have both been evaluated by Engineer.
3. Verify naming convention for equipment identification prior to creation of final drawings, reports, and arc flash hazard warning labels (where applicable).

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Study preparer's qualifications.

C. Field testing agency's qualifications.

D. Study reports, stamped or sealed and signed by study preparer.

E. Product Data: In addition to submittal requirements specified in other sections, include manufacturer's standard catalog pages and data sheets for equipment and protective devices indicating information relevant to studies.

1. Include characteristic time-current trip curves for protective devices.
2. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
3. Include documentation of listed series ratings upon request.
4. Identify modifications made in accordance with studies that:
    a. Can be made at no additional cost to CPL.

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b. As submitted will involve a change to the contract sum.

F. Arc Flash Hazard Warning Label Samples: One of each type and legend specified.

G. Site-specific arc flash hazard warning labels.

H. Field quality control reports.

I. Certification that field adjustable protective devices have been set in accordance with requirements of studies.

J. Project Record Documents: Revise studies as required to reflect as-built conditions.

1. Include hard copies with operation and maintenance data submittals.

2. Include computer software files used to prepare studies with file name(s) cross-referenced to specific pieces of equipment and systems.

1.6 POWER SYSTEM STUDIES

A. Scope of Studies:

1. Perform analysis of both new and existing portions of electrical distribution system.

2. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).

3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.

a. Known Operating Modes:

1) Generator as source.

B. General Study Requirements:

1. Comply with NFPA 70.

2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.

C. Data Collection:

1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.

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a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.

1) Obtain up-to-date information from Utility Company.

2) Utility Company: FirstEnergy.

b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.

c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 00001 code letter designation.

d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.

e. Protective Devices:

1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).

2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).

f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.

g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.

2. Existing Installations:

a. Provide the services of field testing agency or equipment manufacturer's representative to perform field data collection.

b. Collect data on existing electrical distribution system necessary for completion of studies, including field verification of available existing data (e.g. construction documents, previous studies). Include actual settings for field-adjustable devices.

D. Short-Circuit Study:

1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.

2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:

a. Maximum utility fault currents.

b. Maximum motor contribution.

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c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.

E. Arc Flash and Shock Risk Assessment:

1. Comply with NFPA 70E.

2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.

a. Where reasonable, study preparer may assume a maximum clearing time of two seconds in accordance with IEEE 1584, provided that the conditions are such that a worker's egress from an arc flash event would not be inhibited.

b. For single-phase systems, study preparer to perform calculations assuming three-phase system in accordance with IEEE 1584 using single phase bolted fault current, yielding conservative results.

3. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:

a. Maximum and minimum utility fault currents.

b. Maximum and minimum motor contribution.

c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

F. Study Reports:

1. General Requirements:

a. Identify date of study and study preparer.

b. Identify study methodology and software product(s) used.

c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.

d. Identify base used for per unit values.

e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.

f. Include conclusions and recommendations.

2. Short-Circuit Study:

a. For each scenario, identify at each bus location:

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1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).

2) Fault point X/R ratio.

3) Associated equipment short circuit current ratings.

b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.

3. Arc Flash and Shock Risk Assessment:

a. For the worst case for each scenario, identify at each bus location:

1) Calculated incident energy and associated working distance.

2) Calculated arc flash boundary.

3) Bolted fault current.

4) Arcing fault current.

5) Clearing time.

6) Arc gap distance.

b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.

1.7 QUALITY ASSURANCE

A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum five years experience in preparation of studies of similar type and complexity using specified computer software.

1. Study preparer may be employed by manufacturer of electrical distribution equipment.

2. Study preparer may be employed by field testing agency.

B. Field Testing Agency Qualifications: Independent testing organization specializing in testing, analysis, and maintenance of electrical systems with minimum five years experience; NETA Accredited Company.

1. Field Supervisor: Certified electrical testing technician; NETA ETT Level III.

C. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.

1. Products:

a. EasyPower LLC: www.easypower.com/#sle.

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b. ETAP/Operation Technology, Inc: www.etap.com/#sle.

c. Power Analytics Corporation: www.poweranalytics.com/#sle.

d. SKM Systems Analysis, Inc: www.skm.com/#sle.

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

PART 2 PRODUCTS

2.1 ARC FLASH HAZARD WARNING LABELS

A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.

1. Materials: Comply with Section 26 05 53.

2. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.

a. Include orange header that reads "WARNING" unless otherwise indicated.

b. Include the text "Arc Flash and Shock Hazard; Appropriate PPE Required" or approved equivalent.

c. Include the following information:

1) Arc flash boundary.

2) Available incident energy and corresponding working distance.

3) Site-specific PPE (personnel protective equipment) requirements.

4) Nominal system voltage.

5) Limited approach boundary.

6) Restricted approach boundary.

7) Equipment identification.

8) Study preparer, report reference, and date calculations were performed.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install arc flash warning labels in accordance with Section 26 05 53.

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3.2 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Provide the services of field testing agency or equipment manufacturer's representative to perform inspection, testing, and adjusting.

C. Inspect and test in accordance with NETA ATS, except Section 4.

D. Adjust equipment and protective devices for compliance with studies and recommended settings.

E. Notify Engineer of any conflicts with or deviations from studies. Obtain direction before proceeding.

F. Submit detailed reports indicating inspection and testing results, and final adjusted settings.

3.3 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

END OF SECTION 26 05 73

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SECTION 26 09 23 - LIGHTING CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single space wireless lighting control systems and associated components:
   1. Wireless occupancy/vacancy sensors.
   2. Wireless daylight sensors.
   3. Wired load control modules with wireless communication inputs.
   4. Wired wall dimmers and switches with wireless communication inputs.
   5. Wired wallbox occupancy sensors with wireless communication inputs.
   6. Wireless control stations.
   7. LED Drivers.
   8. Power interfaces.
B. Wireless hub(s) for centralized control, monitoring, and system integration.
C. Software data and analytics dashboard, including server requirements.

1.2 RELATED REQUIREMENTS

A. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
B. Section 26 27 26 - Wiring Devices:
   1. Finish requirements for wall controls specified in this section.

1.3 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; current edition.
B. ANSI/ESD S20.20 - For the Development of an Electrostatic Discharge Control Program for – Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices); 2021.
C. ASTM D4674 - Standard Practice for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Office Environments; 2025.

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D. CAL TITLE 24 P6 - California Code of Regulations, Title 24, Part 6 (California Energy Code); 2022, with Supplement (2024).

E. IEC 60929 - AC and/or DC-Supplied Electronic Control Gear for Tubular Fluorescent Lamps - Performance Requirements; 2011, with Amendment (2015).

F. IEC 61000-4-2 - Electromagnetic Compatibility (EMC) - Part 4-2: Testing and Measurement Techniques - Electrostatic Discharge Immunity Test; 2025.

G. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).

H. ISO 9001 - Quality Management Systems — Requirements; 2015, with Amendment (2024).

I. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

J. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

K. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2023.

L. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

M. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

O. UL 508 - Industrial Control Equipment; Current Edition, Including All Revisions.

P. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

Q. UL 1598C - Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits; Current Edition, Including All Revisions.

R. UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces; Current Edition, Including All Revisions.

S. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of sensors and wall controls with millwork, furniture, equipment, etc. installed under other sections or by others.

2. Coordinate the placement of wall controls with actual installed door swings.

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3. Coordinate the placement of daylight sensors with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
4. Coordinate the work to provide luminaires and lamps compatible with the lighting controls to be installed.
5. Coordinate the placement of occupancy sensors with supply diffusers. Occupancy sensors shall not be installed within 4 feet of supply diffusers.
6. Notify Engineer of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Pre-Wire Meeting; Lutron LSC-PREWIRE: Include as part of the base bid additional costs for Lighting Control Manufacturer to conduct on-site meeting prior to commencing work. Manufacturer to review with installer:
1. Low voltage wiring requirements.
2. Separation of power and low voltage/data wiring.
3. Wire labeling.
4. Wireless hub locations and installation.
5. Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in Part 2 under "LIGHTING CONTROLS - GENERAL REQUIREMENTS", sensor locations to be reviewed in accordance with layout provided by Lighting Control Manufacturer. Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated.
6. Control locations.
7. Computer jack locations.
8. Load circuit wiring.
9. Network wiring requirements.
10. Connections to other equipment.
11. Installer responsibilities.

C. Sequencing:
1. Do not install sensors and wall controls until final surface finishes and painting are complete.

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1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Design Documents: Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in Part 2 under "LIGHTING CONTROLS - GENERAL REQUIREMENTS", Lighting Control Manufacturer to provide plans indicating occupancy/vacancy and/or daylight sensor locations.

C. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

1. Occupancy/Vacancy Sensors: Include detailed basic motion detection coverage range diagrams.

2. Wall Dimmers: Include derating information for ganged multiple devices.

D. Samples:

1. Wall Controls:

a. Show available color and finish selections.

b. Provide one sample(s) for each product proposed for substitution upon request.

2. Sensors: Provide one sample(s) for each product proposed for substitution upon request .

E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Project Record Documents: Record actual installed locations and settings for lighting control system components.

G. Operation and Maintenance Data: Include detailed information on lighting control system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications:

1. Company with not less than ten years of experience manufacturing lighting control products using wireless communication between devices.

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2. Registered to ISO 9001, including in-house engineering for product design activities.
3. Provides factory direct technical support hotline available 24 hours per day, 7 days per week.
4. Qualified to supply specified products and to honor claims against product presented in accordance with warranty.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.
   1. Basis of Design System Requirements - Lutron, Unless Otherwise Indicated:
      a. Ambient Temperature:
         1) Lighting Control System Components: Between 32 and 104 degrees F.
      b. Relative Humidity: Less than 90 percent, non-condensing.
      c. Protect lighting controls from dust.

1.9 WARRANTY

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

B. Manufacturer's Standard Warranty, With Manufacturer Full-Scope Start-Up; Lutron Standard 2-Year Warranty; Lutron LSC-B2:
   1. Manufacturer Lighting Control System Components, Except Lighting Management System Computer, Drivers and Load Control Modules:
      a. First Two Years:
         1) 100 percent replacement parts coverage, 100 percent manufacturer labor coverage to troubleshoot and diagnose a lighting issue.
         2) First-available on-site or remote response time.
         3) Remote diagnostics for applicable systems.

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b. Telephone Technical Support: Available 24 hours per day, 7 days per week, excluding manufacturer holidays.

2. Lighting Management System Computer: One year 100 percent parts coverage, one year 100 percent manufacturer labor coverage.

3. Drivers and Load Control Modules:

a. With On-Site Full-Scope Start-Up: Five years 100 percent parts coverage, no manufacturer labor coverage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: Lutron Electronics Company, Inc; Vive; www.lutron.com/#sle.

B. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

2.2 LIGHTING CONTROLS - GENERAL REQUIREMENTS

A. **Sensor Layout and Tuning: Include as part of the base bid additional costs for Lighting Control Manufacturer's Sensor Layout and Tuning service:**

1. **Lighting Control Manufacturer to take full responsibility for wired or wireless occupancy/vacancy and daylight sensor layout and performance for sensors provided by Lighting Control Manufacturer.**

2. **Lighting Control Manufacturer to analyze the reflected ceiling plans, and design a detailed sensor layout that provides adequate occupancy sensor quantity and coverage and ensures occupancy and daylight sensor performance per agreed upon sequence of operations. Contractor to utilize the layouts for sensor placement.**

3. **During startup, Lighting Control Manufacturer to direct Contractor regarding sensor relocation, as required, should conditions require a deviation from locations specified in the drawings.**

4. **Lighting Control Manufacturer to provide up to two additional post-startup on-site service visits, within one calendar year from Date of Substantial Completion to fine-tune sensor calibration per the agreed upon sequence of operations.**

B. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) as suitable for the purpose indicated.

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C. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, programming, etc. as necessary for a complete operating system that provides the control intent indicated.

D. Design lighting control equipment for 10 year operational life while operating continually at any temperature in an ambient temperature range of 32 degrees F to 104 degrees F and 90 percent non-condensing relative humidity.

E. Electrostatic Discharge Tolerance: Design and test equipment to withstand electrostatic discharges without impairment when tested according to IEC 61000-4-2.

F. Power Failure Recovery: When power is interrupted for periods up to 10 years and subsequently restored, lights to automatically return to same levels (dimmed setting, full on, or full off) as prior to power interruption.

G. Wireless Devices:

1. Wireless device family includes area or fixture level sensors, area or fixture level load controls for dimming or switching, and load controls that can be mounted in a wallbox, on a junction box, or at the fixture.
2. Wireless devices including sensors, load controls, and wireless remotes or wall stations, can be set up using simple button press programming without needing any other equipment (e.g. central hub, processor, computer, or other smart device).
3. Wireless hub adds the ability to set up the system using any smart device with a web browser (e.g. smartphone, tablet, PC, or laptop).
4. System does not require a factory technician to set up or program the system.
5. Capable of diagnosing system communications.
6. Capable of having addresses automatically assigned to them.
7. Receives signals from other wireless devices and provides feedback to user.
8. Capable of determining which devices have been addressed.
9. RF Range: 60 feet line-of-sight or 30 feet through typical construction materials between RF transmitting devices and compatible RF receiving devices.
10. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B application.

H. Wireless Network:

1. RF Frequency: 434 MHz; operate in FCC governed frequency spectrum for periodic operation; continuous transmission spectrum is not permitted.

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a. Wireless sensors, wireless wall stations and wireless load control devices do not operate in the noisy 2.4 GHz frequency band where high potential for RF interference exists.

b. Wireless devices operate in an uncongested frequency band providing reliable operation.

c. Fixed network architecture ensures all associated lights and load controls respond in a simultaneous and coordinated fashion from a button press, sensor signal, or command from the wireless hub (i.e. no popcorning).

2. Distributed Architecture: Local room devices communicate directly with each other. If the wireless hub is removed or damaged, local control, sensing, and operation continues to function without interruption.

3. Local room devices communicate directly with each other (and not through a central hub or processor) to ensure:

a. Reliability of system performance.

b. Fast response time to events in the space (e.g. button presses or sensor signals).

c. Independent operation in the event of the wireless hub being removed or damaged.

I. Device Finishes:

1. Wall Controls: Match finishes for Wiring Devices in Section 26 27 26 - Wiring Devices, unless otherwise indicated.

2. Standard Colors: Comply with NEMA WD 1 where applicable.

3. Color Variation in Same Product Family: Maximum delta E of 1, CIE L*a*b color units.

4. Visible Parts: Exhibit ultraviolet color stability when tested with multiple actinic light sources as defined in ASTM D4674. Provide proof of testing upon request.

2.3 WIRELESS SENSORS

A. General Requirements:

1. Operational life of 10 years without the need to replace batteries when installed per manufacturer's instructions.

2. Communicates directly to compatible RF receiving devices through use of a radio frequency communications link.

3. Does not require external power packs, power wiring, or communication wiring.

4. Capable of being placed in test mode to verify correct operation from the face of the unit.

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B. Wireless Occupancy/Vacancy Sensors:

1. General Requirements:

a. Provides a clearly visible method of indication to verify that motion is being detected during testing and that the unit is communicating to compatible RF receiving devices.

b. Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.

c. Sensing Mechanism: Passive infrared coupled with technology for sensing fine motions. Signal processing technology detects fine-motion passive infrared (PIR) signals without the need to change the sensor's sensitivity threshold.

d. Provide optional, readily accessible, user-adjustable controls for timeout, automatic/manual-on, and sensitivity.

e. Turns off lighting after reasonable and adjustable time delay once the last person to occupy the space vacates a room or area. Provide adjustable timeout settings of 1, 5, 15, and 30 minutes.

f. Capable of turning dimmer's lighting load on to an optional locked preset level selectable by the user. Locked preset range to be selectable on the dimmer from 1 percent to 100 percent.

g. Color: White.

h. Provide all necessary mounting hardware and instructions for both temporary and permanent mounting.

i. Provide temporary mounting means for drop ceilings to allow user to check proper performance and relocate as needed before permanently mounting sensor. Temporary mounting method to be design for easy, damage-free removal.

j. Sensor lens to illuminate during test mode when motion is detected to allow installer to place sensor in ideal location and to verify coverage prior to permanent mounting.

k. Ceiling-Mounted Sensors:

1) Provide surface mounting bracket compatible with drywall, plaster, wood, concrete, and compressed fiber ceilings.

2. Wireless Combination Occupancy/Vacancy Sensors:

a. Ceiling-Mounted Sensors: Programmable to operate as an occupancy sensor (automatic-on and automatic-off), an occupancy sensor with low light feature (automatic-on when less than one footcandle of ambient light available and automatic-off), or a vacancy sensor (manual-on and automatic-off).

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b. Product(s):

1) Ceiling-Mounted Occupancy/Vacancy Sensor; Lutron Radio Powr Savr Series, Model LFR2-OCR2B-P-WH: Coverage from 324 square feet to 676 square feet depending on ceiling height from 8 to 12 feet; 360 degree field of view.

C. Wireless Daylight Sensors:

1. Product: Lutron Radio Powr Savr Series, Model LFR2-DCRB-WH.
2. Open-loop basis for daylight sensor control scheme.
3. Stable output over temperature from 32 degrees F to 104 degrees F.
4. Partially shielded for accurate detection of available daylight to prevent fixture lighting and horizontal light component from skewing sensor detection.
5. Provide linear response from 2 to 150 footcandles.
6. Color: White.
7. Mounting:
   a. Provide surface mounting bracket compatible with drywall, plaster, wood, concrete, and compressed fiber ceilings.
   b. Provide all necessary mounting hardware and instructions for both temporary and permanent mounting.
   c. Provide temporary mounting means for drop ceilings to allow user to check proper performance and relocate as needed before permanently mounting sensor. Temporary mounting method to be design for easy, damage-free removal.

2.4 LOAD CONTROL MODULES

A. Provide wireless load control modules as indicated or as required to control the loads as indicated.

B. Junction Box-Mounted Modules:

1. Plenum rated.
2. 0-10 V Dimming Modules:
   a. Product(s):
   b. Communicates via radio frequency with up to ten compatible occupancy/vacancy sensors, ten wireless control stations, and one daylight sensor.
   c. Single low voltage dimming module with Class 1 or Class 2 isolated 0-10V output signal conforming to IEC 60929 Annex E.2; source or sink automatically configures.

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d. Selectable minimum light level.

e. Configurable high- and low-end trim.

f. Relay: Rated for 0-10 V ballasts, LED drivers, or fixtures that conform with NEMA 410.

2.5 WIRED WALL DIMMERS AND SWITCHES WITH WIRELESS COMMUNICATION INPUTS

A. General Requirements:

1. Provide air gap service switch to disconnect power to load for safe lamp replacement, accessible without removing faceplate.
2. Operates at the rated capacity across the full ambient temperature range including modified capacities for ganged configurations which require removal of fins.
3. Provide radio frequency interference suppression.
4. Surge Tolerance: Designed and tested to withstand surges of 6,000 V, 200 amps according to IEEE C62.41.2 without impairment to performance.
5. Dimmers: Provide full range, continuously variable control of light intensity.
6. Dimmers for Electronic Low Voltage (ELV) Transformers:
   a. Provide circuitry designed to control the input of electronic (solid-state) low voltage (ELV) transformers. Do not use dimmers that utilize standard phase control.
   b. Provide resettable overload protection that provides automatic shut-off when dimmer capacity is exceeded. Do not use protection methods that are non-resettable or require device to be removed from outlet box.
   c. Designed to withstand a short, per UL 1472, between load hot and either neutral or ground without damage to dimmer.
7. Dimmers for Magnetic Low Voltage (MLV) Transformers:
   a. Provide circuitry designed to control and provide a symmetrical AC waveform to input of magnetic low voltage transformers per UL 1472.
   b. Magnetic low voltage transformers to operate below rated current or temperature.
8. Electronic Switches:
   a. Listed as complying with UL 20, UL 508, and UL 1472.

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2.6 WIRED WALLBOX OCCUPANCY SENSORS WITH WIRELESS COMMUNICATION INPUTS

A. 0-10 V Wall Dimmer/Switch Combination Occupancy/Vacancy Sensors with Wireless Communication Inputs; Lutron Maestro Wireless 0-10 V Dimmer Sensor/Maestro Wireless Sensor Switch Series.

1. Communicates via radio frequency with up to ten compatible wireless occupancy/vacancy sensors, ten wireless control stations, and one wireless daylight sensor.
2. Compatible with sourcing electronic 0-10 V ballasts/drivers, as per IEC 60929 Annex E.2 0-10 V protocol.
3. Selectable option to enable low light feature (automatic-on when ambient light is below threshold). Ambient light threshold to be selectable as either adaptive utilizing occupant feedback (Lutron Smart Ambient Light Detection) or as fixed (high, medium, low, and minimum presets).
4. Dimmer Features:
    a. Adjustable high/low end trims.
    b. Selectable dimming curve (linear or switched).
    c. Selectable fade on/fade off times (15, 5, 2.5, or 0.75 sec).
    d. Adjustable auto-on light level (fully adjustable from one to 100 percent).
5. Dimmer Control: Multi-function tap switch with small, raised rocker for dimmer adjustment.
    a. Rocker raises/lowers light level, with new level becoming the current preset level.
    b. Switch single tap raises lights to preset level or fades lights to off.
    c. Switch double tap raises light to full on level.
6. Switch Control: Switch single tap turns lights on/off.
7. Product(s):

2.7 WIRELESS CONTROL STATIONS

A. General Requirements:

1. Communicates directly to compatible RF receiving devices through use of a radio frequency communications link.
2. Allows for easy reprogramming without replacing unit.
3. Button Programming:

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a. Single action.

b. Toggle action.

4. Includes LED to indicate button press or programming mode status.

5. Faceplates: Provide concealed mounting hardware.

6. Finish: As specified for wall controls in "Device Finishes" under LIGHTING CONTROLS - GENERAL REQUIREMENTS article above.

2.8 LED DRIVERS

A. General Requirements:

1. Operate for at least 50,000 hours at maximum case temperature and 90 percent non-condensing relative humidity.

2. Provide thermal fold-back protection by automatically reducing power output (dimming) to protect LED driver and LED light engine/fixture from damage due to over-temperature conditions that approach or exceed the LED driver's maximum operating temperature at calibration point.

3. Provide integral recording of operating hours and maximum operating temperature to aid in troubleshooting and warranty claims.

4. Designed and tested to withstand electrostatic discharges incurred during manufacturing, installation, or field troubleshooting without impairment of performance when tested according to IEC 61000-4-2.

5. Manufactured in a facility that employs ESD reduction practices in compliance with ANSI/ESD S20.20.

6. UL 8750 recognized or listed as applicable.

7. UL Type TL rated or UL Class P listed where possible to allow for easier fixture evaluation and listing of different driver series.

8. Suitable for field replacement as applicable; listed in accordance with UL 1598C or UL 8750, Class P as indicated.

9. Designed and tested to withstand Category A surges of 4,000 V according to IEEE C62.41.2 without impairment of performance.

10. Class A sound rating; inaudible in a 27 dBA ambient.

11. Demonstrate no visible change in light output with a variation of plus or minus 10 percent change in line-voltage input.

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12. LED drivers of the same family/series to track evenly across multiple fixtures at all light levels.
13. Offer programmable output currents in 10 mA increments within designed driver operating ranges for custom fixture length and lumen output configurations, while meeting a low-end dimming range of 100 to 0.1 percent, 100 to 1 percent or 100 to 5 percent as applicable.
14. Meet NEMA 410 inrush requirements for mitigating inrush currents with solid state lighting sources.
15. Employ integral fault protection up to 277 V to prevent LED driver damage or failure in the event of incorrect application of line-voltage to communication link inputs.
16. LED driver may be remote located up to 100 feet from LED light engine depending on power outputs required and wire gauge utilized by installer.

2.9 POWER INTERFACES

A. Provide power interfaces as indicated or as required to control the loads as indicated.

B. General Requirements:

1. Phase independent of control input.
2. Dimmer to meet limited short circuit test as defined in UL 508.
3. Utilize air gap off to disconnect the load from line supply.
4. Diagnostics and Service: Replacing power interface does not require re-programming of system or processor.

C. Product(s):

2.10 WIRELESS HUBS

A. Product(s):

B. Integrated multicolor LED provides feedback on what mode the hub is in for simple identification and diagnosis.

C. Integrated processor and web server allows hub to set up and operate the system without any external connections to outside processors, servers, or the internet.

D. Utilizes Ethernet connection for:

1. Networking up to 64 hubs together to create a larger system.

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2. Integration with Building Management System (BMS) via native BACnet; does not require interface (wireless hub with BACnet only).
3. Remote connectivity capabilities, including maintaining system date/time and receiving periodic firmware updates (requires internet connection).

E. A single hub or network of hubs can operate on either a dedicated lighting control only network or can be integrated with an existing building network as a VLAN.

F. Communicates directly to compatible Lutron Vive RF devices through use of Lutron Clear Connect radio frequency communications link; does not require communication wiring; RF range of 71 feet through walls to cover an area of 15836 square feet (device and hub must be on the same floor).

G. Communicates directly to mobile device (smartphone or tablet) or computer using built-in Wi-Fi. 2.4 GHz 802.11b/g; wireless range of 71 feet through walls (device and hub must be on the same floor).

1. Does not require Wi-Fi router for connecting to the hub.

H. Allows for system setup, control, and monitoring from mobile device or computer using Vive web-based software:

1. Supports paired devices up to maximum number indicated including compatible wireless sensors, wireless control stations, and wireless load devices.
2. Allows for timeclock scheduling of events, both time of day and astronomic (sunrise and sunset).
    a. Timeclock is integrated into the unit and does not require a constant internet connection.
    b. Retains time and programming information after a power loss.
    c. 365-day schedulable timeclock allows for:
        1) Scheduling of events years in advance.
        2) Setting of recurring events with exceptions on holidays.
    d. Timeclock events can be scheduled to:
        1) Send lights to a desired level and select the fade rate desired to reach that level.
        2) Adjust level lights go to when occupied.
        3) Adjust level lights go to when unoccupied.
        4) Enable/disable occupancy.

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5) Adjust timeout of sensors (requires Lutron Model FC-SENSOR wired fixture sensor or Lutron Model DFCSJ-OEM-OCC wireless fixture control dongle with integral sensing capabilities).

3. Daylighting:
   a. Daylighting can be enabled/disabled. Can be used to override the control currently taking place in the space.
   b. Daylight set point can be adjusted with the software to increase or decrease the electric light level in the room based on the same amount of natural light.
4. Allows for control, monitoring, and adjustment from anywhere in the world (Lutron Vive wireless hub internet connection required).
5. Uses RF signal strength detection to find nearby devices for quick association and programming without having to climb ladders.
   a. Association and setup does not require a factory technician to perform.
6. System using Lutron Vive wireless hub(s) can operate with or without connection to the internet.
7. Supports energy reporting.
   a. Reports measured energy data for PowPak fixture control modules at accuracy of plus/minus 2 percent or 0.5 W (whichever is higher).
   b. Reports calculated energy data for PowPak junction box mounted modules at accuracy of 10 percent.
8. Supports automatic demand response for load shedding via:
   a. Local contact closure without need for separate interface.
   b. OpenADR® 2.0b compliant utility command.
   c. BACnet (wireless hub with BACnet only).
9. Support automatic generation of alerts in Lutron Vive web-based application for designated events/triggers, including:
   a. Low-battery condition in battery-operated sensors and controls; alert cleared when battery is replaced.
   b. Missing device (e.g., control or sensor); alert cleared when device is detected.
10. Wireless hub can be firmware upgraded to provide new software features and system updates.
    a. Firmware update can be done either locally using a wired Ethernet connection or Wi-Fi connection, or remotely if the wireless hub is connected to the internet.

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I. Lutron Vive Web-Based Application:

1. Accessibility and Platform Support:

a. Web-based; runs on most HTML5 compatible browsers (including Safari and Chrome).

b. Supports multiple platforms and devices; runs from a tablet, desktop, laptop, or smartphone.

c. User interface supports multi-touch gestures such as pinch to zoom, drag to pan, etc.

d. Utilizes HTTPS (industry-standard certificate-based encryption and authentication for security).

e. Multi-level Password Protected Access: Individual password protection on both the integrated Wi-Fi network and web-based software.

f. WPA2 security for Wi-Fi communication with wireless hub.

2. System Navigation and Status Reporting:

a. Area Tree View: Easy navigation by area name to view status and make programming adjustments through the software.

b. Area and device names can be changed in real time.

3. Setup app available for iOS and Android that allows for:

a. Job registration to extend product warranty.

b. Management of setup for multiple projects in different locations.

c. Creation of handoff documents that are sent directly to a facility manager via email once setup is complete.

d. Backup of Vive wireless hub database to Lutron cloud for hub replacement.

e. Access to native help and instructions to assist user with Vive system setup.

J. API Integration:

1. Support communication, without requiring interface, between lighting control system and third-party system via RESTful API.

2. Requires one network connection per wireless hub.

3. API Integration Capabilities:

a. Control all zones or subset of zones.

1) Set zones in designated area to specific level.

2) Raise/lower dimmable lights in designated area.

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b. Control individual zones.

c. Subscribe to and Monitor:

1) Area status changes (e.g, occupancy, light level, and instantaneous power).

2) Individual zone changes in light level.

3) Alerts (e.g., missing device and low battery).

K. Scenes:

1. Support programmable scenes to control individual devices, areas, or groups of areas on demand.

2. Scenes may be activated via:

a. Contact closure input.

b. API integration.

c. Manual activation in app.

L. Emergency Mode:

1. Support emergency mode to, when triggered, send lights to defined levels and lock out controls for PowPak load control modules equipped with emergency mode.

2. Emergency mode may be activated via:

a. Contact closure input.

b. API integration.

c. Manual activation in app.

M. Contact Closure Interface: Provide two contact closure inputs; accepts both momentary and maintained contact closures that can be used for automatic demand response.

N. Rated for use in air-handling spaces as defined in UL 2043.

O. Meets CAL TITLE 24 P6 requirements.

P. Provide Ethernet switch(es) as required for inter-hub network wiring per manufacturer's instructions; do not exceed manufacturer's required maximum wiring segment lengths.

2.11 SOFTWARE DATA AND ANALYTICS DASHBOARD

A. Control and Monitor Software:

1. Product: Lutron Vive Vue.

2. General Requirements:

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a. Web-based; runs on most HTML5 compatible browsers (including Internet Explorer, Chrome, and Safari).

b. Supports multiple platforms and devices; runs from a tablet, desktop, laptop, or smartphone; optimized for displays of 1024 by 768 pixels or higher.

c. User interface supports multi-touch gestures such as pinch to zoom, drag to pan, etc.

d. Utilizes HTTPS (industry-standard certificate-based encryption and authentication for security).

e. All functionality listed below must be available via a single application.

3. System Navigation and Status Reporting:

a. Performed using graphical floor plan view or a generic system layout.

b. Graphical Floor Plan View: Utilizes customized CAD based drawing of the building. Pan and zoom feature allows for easy navigation; dynamically adjusts the details presented based on zoom level.

4. Control of Lights:

a. Control and monitor zone/area lights.

1) Area lights can be monitored for on/off status from a graphical floor plan or generic system layout.

2) All lights in an area can be turned on/off (dimmable lights can also be dimmed up/down from current level).

5. Occupancy:

a. Area occupancy can be monitored.

1) Can be monitored graphically if a graphical floor plan has been created.

2) Can be monitored historically in space utilization reports.

b. Scheduled events can be created to change occupancy parameters as described under "Scheduling" below.

6. Load Shedding: View current load shed status (active/inactive) for each Vive wireless hub and enable/disable load shed for the entire building/system.

7. Scheduling: Schedule time of day and astronomic time clock events to automate functions.

a. Scheduled events can control the following:

1) Area light levels for all dimmable lights in an area.

2) On/off status of all switched lights and contact-closure outputs in an area.

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3) On/off status of all switched receptacles in an area.

4) Occupancy parameters as follows:

(a) Enable/disable sensors.

(b) Change occupancy mode (auto-on/auto-off versus manual-on/auto-off).

(c) Adjust occupied and/or unoccupied level.

(d) For compatible individual fixture sensors, sensor timeout can be adjusted.

b. Easily monitor and adjust scheduled events using a weekly calendar view.

8. Reporting: Provide reporting capability that allows the building manager to gather real-time and historical information about the system as follows:

a. Energy Reports: Show a comparison of cumulative energy used over a period of time for one or more areas.

b. Power Reports: Show power usage trend over a period of time for one or more areas.

c. Space Utilization/Occupancy Reports: Show historical occupancy over a period of time for one or more areas using a graphical floor plan, generic system layout, and graphs and charts.

9. Administration:

a. Users: Allows new user accounts to be created and existing user accounts to be edited.

1) Supports Active Directory (LDAP) tying user accounts to network accounts.

b. Area and feature access can be restricted based on login credentials.

c. Supports up to 20 concurrent users and 10,000 user accounts.

10. Devices/Settings Adjustment:

a. Users with appropriate permissions can navigate to the wireless hub setup screens in order to view and/or adjust specific settings for areas or devices (including load shed settings, daylighting settings, device associations and programming, occupancy settings, high-end/low-end trim settings, etc).

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

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B. Verify that ratings and configurations of system components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive system components.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

3.3 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, except for mounting heights specified in those standards.

B. Install products in accordance with manufacturer's instructions.

C. Sensor Locations:

1. Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in Part 2 under "LIGHTING CONTROLS - GENERAL REQUIREMENTS", locate sensors in accordance with layout provided by Lighting Control Manufacturer. Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated. ~~**Where Lighting Control Manufacturer Sensor Layout and Tuning service is not specified, locate sensors in accordance with Drawings.**~~

D. Ensure that daylight sensor placement minimizes sensor view of electric light sources. Locate ceiling-mounted and luminaire-mounted daylight sensors to avoid direct view of luminaires.

E. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

F. LED Light Engine/Array Lead Length: Do not exceed 100 feet.

G. Identify system components in accordance with Section 26 05 53.

3.4 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Manufacturer's Full-Scope Start-Up Service is required.

C. Manufacturer's Full-Scope Start-Up Service: Provide manufacturer's On-Site Full-Scope Start-Up Service.

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1. On-Site Full-Scope Start-Up Service; Lutron LSC-OS-SU-VIVE: Manufacturer's authorized Service Representative to conduct site visit upon completion of lighting control system installation to perform system start-up and verify proper operation:
    a. Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in Part 2 under "LIGHTING CONTROLS - GENERAL REQUIREMENTS", authorized Service Representative to verify sensor locations, in accordance with layout provided by Lighting Control Manufacturer. Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated.
    b. Verify connection of power wiring and load circuits.
    c. Verify connection and location of controls.
    d. Energize wireless hubs.
    e. Associate occupancy/vacancy sensors, daylight sensors, wireless remotes, and wall stations to load control devices.
    f. Provide initial rough calibration of sensors; fine-tuning of sensors is responsibility of Contractor unless provided by Lighting Control Manufacturer as part of Sensor Layout and Tuning service where specified in Part 2 under "LIGHTING CONTROLS - GENERAL REQUIREMENTS".
    g. Program timeclock schedules per approved sequence of operations.
    h. Configure load shed parameters per approved sequence of operations.
    i. Verify system operation control by control.
    j. Obtain sign-off on system functions.
    k. Train CPL's representative on system capabilities, operation, and maintenance, as specified in Part 3 under "Closeout Activities".

D. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

3.5 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.6 COMMISSIONING

A. See Section 01 91 13 - General Commissioning Requirements for commissioning requirements.

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3.7 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Demonstration:

1. Demonstrate proper operation of lighting control devices to Engineer, and correct deficiencies or make adjustments as directed.

D. Training:

1. Include services of manufacturer's certified service representative to perform on-site training of CPL's personnel on operation, adjustment, and maintenance of lighting control system as part of on-site system start-up services.

E. Functional Testing

1. Include as part of base bid additional costs for manufacturer's authorized Service Representative to perform functional testing of lighting controls system. At a minimum, the following procedures shall be performed:

a. Confirm that the placement, sensitivity and time-out adjustments for occupant sensors yield acceptable performance, that lights turn off only after space is vacated, and that they do not turn on unless space is occupied.

b. Confirm that the time switches and programmable schedule controls are programmed to turn the lights off.

c. Confirm that photosensor controls reduce electric light levels based on the amount of usable daylight in the space as specified.

3.8 PROTECTION

A. Protect installed products from subsequent construction operations.

END OF SECTION 26 09 23

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SECTION 26 24 16 - PANELBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.2 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 05 73 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

E. Section 26 43 00 - Surge Protective Devices.

1.3 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2025.

D. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

E. NEMA PB 1 - Panelboards; 2011.

F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 1000V or Less; 2023.

G. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

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I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

K. UL 67 - Panelboards; Current Edition, Including All Revisions.

L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

M. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

N. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.

4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

5. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

1. Include characteristic trip curves for each type and rating of overcurrent protective device.

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C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
2. Include wiring diagrams showing all factory and field connections.
3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
4. Include documentation of listed series ratings.

D. Manufacturer's equipment seismic qualification certification.

E. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.

F. Field Quality Control Test Reports.

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

H. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

I. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

J. Maintenance Materials: Furnish the following for CPL's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Panelboard Keys: Two of each different key.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

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

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

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1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:

1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB: www.electrification.us.abb.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric: www.se.com/#sle.

D. Siemens Industry, Inc: www.new.siemens.com/#sle.

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

F. Source Limitations: Provide panelboards and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from a single supplier.

2.2 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet.

2. Ambient Temperature:

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a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

C. Short Circuit Current Rating:

1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.

2. Listed series ratings are acceptable, except where not permitted by motor contribution according to NFPA 70.

3. Label equipment utilizing series ratings as required by NFPA 70.

D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

F. Bussing: Sized in accordance with UL 67 temperature rise requirements.

1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.

2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:

a. Indoor Clean, Dry Locations: Type 1.

b. Outdoor Locations: Type 3R.

2. Boxes: Galvanized steel unless otherwise indicated.

a. Provide wiring gutters sized to accommodate the conductors to be installed.

b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.

c. Provide removable end walls for NEMA Type 1 enclosures.

d. Provide painted steel boxes for surface-mounted panelboards, finish to match fronts.

3. Fronts:

a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.

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b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.

c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.

4. Lockable Doors: All locks keyed alike unless otherwise indicated.

I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

J. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 43 00, list and label panelboards as a complete assembly including surge protective device.

K. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.

1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.

L. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

M. Load centers are not acceptable.

2.3 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:

1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.

2. Main and Neutral Lug Type: Mechanical.

C. Bussing:

1. Phase and Neutral Bus Material: Copper.

2. Ground Bus Material: Copper.

D. Circuit Breakers:

1. Provide bolt-on type.

E. Enclosures:

1. Provide surface-mounted enclosures as indicated.

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2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

2.4 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
2. Phase and Neutral Bus Material: Copper.
3. Ground Bus Material: Copper.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:
1. Provide surface-mounted or flush-mounted enclosures as indicated.
2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

2.5 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:
1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
2. Interrupting Capacity:

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a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:

1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.

b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

c. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.

3. Conductor Terminations:

a. Provide mechanical lugs unless otherwise indicated.

b. Lug Material: Copper, suitable for terminating copper conductors only.

4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.

a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.

b. Provide interchangeable trip units where indicated.

5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.

a. Provide the following field-adjustable trip response settings:

1) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.

2) Long time delay.

3) Short time pickup and delay.

4) Instantaneous pickup.

5) Ground fault pickup and delay where ground fault protection is indicated.

6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

7. Provide the following circuit breaker types where indicated:

a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.

b. Ground Fault Protection for Equipment (GFPE) Circuit Breakers: Designed to trip at 30 mA for protection of equipment.

8. Do not use tandem circuit breakers.

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9. Do not use handle ties in lieu of multi-pole circuit breakers.
10. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.

2.6 SOURCE QUALITY CONTROL

A. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment in accordance with Section 26 05 29.

F. Install panelboards plumb.

G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

I. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

J. Provide grounding and bonding in accordance with Section 26 05 26.

K. Install all field-installed branch devices, components, and accessories.

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L. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

M. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

N. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 05 73.

O. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

P. Provide filler plates to cover unused spaces in panelboards.

Q. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:

1. Emergency and night lighting circuits.
2. Fire detection and alarm circuits.
3. Communications equipment circuits.
4. Intrusion detection and access control system circuits.
5. Video surveillance system circuits.

R. Identify panelboards in accordance with Section 26 05 53.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 100 amperes. Tests listed as optional are not required.

D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.

E. Test GFCI circuit breakers to verify proper operation.

F. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

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G. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.5 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 24 16

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SECTION 26 27 26 - WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall switches.

B. Receptacles.

C. Wall plates and covers.

D. Floor box service fittings.

E. Access floor boxes.

1.2 RELATED REQUIREMENTS

A. Section 09 69 33 - Low-Profile Fixed Height Access Flooring

B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.

C. Section 26 05 33.16 - Boxes for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 27 10 00 - Structured Cabling: Voice and data jacks.

1.3 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h (Validated 2022).

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification); 2017g (Validated 2023).

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

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H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

L. UL 1310 - Class 2 Power Units; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.

2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.

3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.

4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.

5. Notify Engineer of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:

1. Do not install wiring devices until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

C. Field Quality Control Test Reports.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Operation and Maintenance Data:

1. GFCI Receptacles: Include information on status indicators.

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F. Project Record Documents: Record actual installed locations of wiring devices.

G. Maintenance Materials: Furnish the following for CPL's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.

2. Extra Wall Plates: One of each style, size, and finish.

3. Extra Flush Floor Service Fittings: Two of each type.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

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

D. Products: Listed, classified, and labeled as suitable for the purpose intended.

E. Product Evaluation and Listing Organization Qualifications: Organization engaged in evaluation of products and services, including those recognized by OSHA as Nationally Recognized Testing Laboratories (NRTL), and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.1 WIRING DEVICES - GENERAL REQUIREMENTS

A. Provide wiring devices suitable for intended use with ratings adequate for load served.

B. Except where explicitly permitted, substitution of combination switch-and-receptacle devices for separate switches and receptacles is not permitted.

C. Wiring Device Applications:

1. Receptacles Installed Outdoors or in Damp or Wet Locations: Use weather-resistant GFCI receptacles with weatherproof covers.

2. Receptacles Installed in Public Areas: Use tamper-resistant receptacles.

3. Provide GFCI protection for:

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a. Receptacles installed within 6 feet of sinks.

b. Receptacles installed in kitchens.

c. Receptacles serving electric drinking fountains.

4. Single Receptacles Installed on Individual Branch Circuits: Provide receptacle ampere rating equal to branch circuit rating.

5. Wiring Device finishes to be selected by Architect.

D. Wiring Device Finishes:

1. Provide wiring device finishes as described below, unless otherwise indicated.

2. Wiring Devices, Unless Otherwise Indicated: White with white nylon wall plate.

3. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate.

4. Wiring Devices Installed in Wet or Damp Locations: White with lockable weatherproof cover.

5. Flush Floor Box Service Fittings: Gray wiring devices with brass cover and ring/flange.

6. Access Floor Boxes: Gray wiring devices with gray steel cover with insert to match floor covering.

2.2 WALL SWITCHES

A. Manufacturers:

1. Hubbell Incorporated; _____: www.hubbell.com/#sle.

2. Leviton Manufacturing Company, Inc; _____: www.leviton.com/#sle.

3. Pass & Seymour, a brand of Legrand North America, Inc; _____: www.legrand.us/#sle.

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

B. General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

C. Standard Wall Switches: Commercial specification grade, 20 A, 120 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

D. Pilot Light Wall Switches: Commercial specification grade, 20 A, 120/277 V with red illuminated standard toggle type switch actuator and maintained contacts; illuminated with

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load on; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.3 RECEPTACLES

A. Manufacturers:

1. Hubbell Incorporated: www.hubbell.com/#sle.
2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
3. Lutron Electronics Company, Inc: www.lutron.com/#sle.
4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:

1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
2. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
3. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
4. Tamper Resistant and Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

D. GFCI Receptacles:

1. General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.

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a. Provide test and reset buttons of same color as device.

b. Provide remote test and reset button as indicated on drawings.

2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.

3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.

4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.

5. Tamper Resistant and Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.

E. USB Charging Devices:

1. General Requirements: Listed as complying with UL 1310.

a. Charging Capacity - Two-Port Devices: 2.1 A, minimum.

2. USB Charging/Tamper Resistant Receptacle Combination Devices: Two-port (Type A and Type C) USB charging device and receptacle, commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; rectangular decorator style.

2.4 WALL PLATES AND COVERS

A. Manufacturers:

1. Hubbell Incorporated: www.hubbell-wiring.com/#sle.

2. Intermatic, Inc: www.intermatic.com/#sle.

3. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.

4. Lutron Electronics Company, Inc: www.lutron.com/#sle.

5. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

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

B. Wall Plates: Comply with UL 514D.

1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.

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2. Size: Standard.
3. Screws: Metal with slotted heads finished to match wall plate finish.

C. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.

D. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

E. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.

F. Weatherproof Receptacle Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

G. Weatherproof Receptacle Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

H. Weatherproof Switch Covers for Wet or Damp Locations: Gasketed, metallic, with externally operable actuating means and corrosion-resistant screws; listed as suitable for use in wet locations.

2.5 FLOOR BOX SERVICE FITTINGS

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell.com/#sle.
2. Thomas & Betts Corporation: www.tnb.com/#sle.
3. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: Service fittings compatible with floor boxes provided under Section 26 05 33.16 with components, adapters, and trims required for complete installation.

C. Flush Floor Service Fittings:
1. Single Service Flush Convenience Receptacles:
a. Cover: Rectangular.
b. Configuration: As indicated on drawings.
2. Single Service Flush Communications Outlets:
a. Cover: Rectangular.
b. Configuration: As indicated on drawings.
c. Voice and Data Jacks: As specified in Section 27 10 00.

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3. Single Service Flush Furniture Feed:
    a. Cover: Rectangular.
    b. Configuration: One 2-1/8 inch by 3/4 inch combination threaded opening(s), unless indicated otherwise.
4. Dual Service Flush Combination Outlets:
    a. Cover: Rectangular.
    b. Configuration:
        1) Power: As indicated on drawings.
        2) Communications: As indicated on drawings.
        3) Voice and Data Jacks: As specified in Section 27 10 00.
5. Dual Service Flush Furniture Feed:
    a. Cover: Rectangular.
    b. Configuration:
        1) Power: One 2-1/8 inch by 3/4 inch combination threaded opening(s), unless otherwise indicated.
        2) Communications: One 2-1/8 inch by 1 inch combination threaded opening(s), unless other.
6. Accessories:
    a. Tile Rings: Finish to match covers; configuration as required to accommodate specified covers.
    b. Carpet Flanges: Finish to match covers; configuration as required to accommodate specified covers.

2.6 ACCESS FLOOR BOXES

A. Manufacturers - Access Floor Boxes with Pre-wired Connectors for Manufactured Wiring Systems:
    1. FreeAxez: https://www.freeaxez.com/gridd-power/
    2. AFC Cable Systems Inc: www.afcweb.com/#sle.
    3. RELOC Wiring Solutions, a brand of Acuity Brands, Inc: www.relocwiring.com/#sle.
    4. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/#sle.
    5. Substitutions: See Section 01 60 00 - Product Requirements.

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a. Substitutions must be compatible with FreeAxez floor system as specified in Section 09 69 33 Low-Profile Fixed Height Access Flooring.

B. Description: Metallic multi-service box suitable for mounting in access floor system specified in Section 09 69 33 Low-Profile Fixed Height Access Flooring.

C. Access floor boxes with pre-wired connectors for manufactured wiring systems are permitted only where manufactured wiring systems are permitted as specified in Section 26 05 19.

D. Configuration:

1. Power: As indicated on drawings.
2. Communications: As indicated on drawings.
3. Voice and Data Jacks: As specified in Section 27 10 00.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that floor boxes are adjusted properly.

F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

G. Verify that openings in access floor are in proper locations.

H. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

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3.3 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of wiring devices provided under this section.

1. Mounting Heights: As indicated on the drawings.

2. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.

3. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Engineer to obtain direction prior to proceeding with work.

4. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I. Install wiring devices plumb and level with mounting yoke held rigidly in place.

J. Install wall switches with OFF position down.

K. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

L. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

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M. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

N. Identify wiring devices in accordance with Section 26 05 53.

3.4 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each wiring device for damage and defects.

C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

D. Test each receptacle to verify operation and proper polarity.

E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.6 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION 26 27 26

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SECTION 26 28 13 - FUSES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fuses.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

D. UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses; Current Edition, Including All Revisions.

E. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.

2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.

3. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

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1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

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

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Bussmann, a division of Eaton Corporation; _____: www.cooperindustries.com/#sle.

B. Littelfuse, Inc; _____: www.littelfuse.com/#sle.

C. Mersen; _____: ep-us.mersen.com/#sle.

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

2.2 APPLICATIONS

A. Service Entrance:

1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.

B. Feeders:

1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.

C. General Purpose Branch Circuits: Class RK1, time-delay.

D. Individual Motor Branch Circuits: Class RK1, time-delay.

E. In-Line Protection for Pole-Mounted Luminaires: Class CC, time-delay.

2.3 FUSES

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

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D. Comply with UL 248-1.

E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Class R Fuses: Comply with UL 248-12.

1. Class RK1, Time-Delay Fuses:

H. Class CC Fuses: Comply with UL 248-4.

1. Class CC, Time-Delay Fuses:

I. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

J. Provide the following accessories where indicated or where required to complete installation:

1. Fuseholders: Compatible with indicated fuses.

2. Fuse Reducers: For adapting indicated fuses to permit installation in switch designed for fuses with larger ampere ratings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION 26 28 13

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SECTION 26 28 16.16 - ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Enclosed safety switches.

1.2 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 05 73 - Power System Studies: Additional criteria for the selection of equipment and associated protective devices specified in this section.

E. Section 26 28 13 - Fuses.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

C. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).

D. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

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1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include dimensioned plan and elevation views of enclosed switches and adjacent equipment with all required clearances indicated.
2. Include wiring diagrams showing all factory and field connections.

D. Field Quality Control Test Reports.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

F. Project Record Documents: Record actual locations of enclosed switches.

G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

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B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

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

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB: www.electrification.us.abb.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric: www.se.com/#sle.

D. Siemens Industry, Inc: www.new.siemens.com/#sle.

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

F. Source Limitations: Provide enclosed switches and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

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2.2 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet.

2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

D. Horsepower Rating: Suitable for connected load.

E. Voltage Rating: Suitable for circuit voltage.

F. Short Circuit Current Rating:

1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.

G. Provide with switch blade contact position that is visible when the cover is open.

H. Fuse Clips for Fusible Switches: As required to accept fuses indicated.

1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

I. Conductor Terminations: Suitable for use with the conductors to be installed.

J. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

K. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

L. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:

a. Indoor Clean, Dry Locations: Type 1.

b. Outdoor Locations: Type 3R.

2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

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M. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

N. Heavy Duty Switches:

1. Comply with NEMA BS 31047.

2. Conductor Terminations:

a. Provide mechanical lugs unless otherwise indicated.

b. Lug Material: Copper, suitable for terminating copper conductors only.

3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

a. Provide means for locking handle in the ON position where indicated.

O. Provide the following features and accessories where indicated or where required to complete installation:

1. Hubs: As required for environment type; sized to accept conduits to be installed.

2. Integral fuse pullers.

3. Auxiliary Switch: SPDT switch suitable for connection to system indicated, with auxiliary contact operation before switch blades open and after switch blades close.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

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

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

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D. Provide required support and attachment in accordance with Section 26 05 29.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 05 26.

H. Provide fuses complying with Section 26 28 13 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

I. Identify enclosed switches in accordance with Section 26 05 53.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 28 16.16

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SECTION 26 36 00 - TRANSFER SWITCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Transfer switches for low-voltage (600 V and less) applications.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 29 - Hangers and Supports for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 05 73 - Power System Studies: Additional criteria for the selection of equipment specified in this section.

F. Section 26 36 33 - Connection Cabinets for Portable Generators and Load Banks.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

C. NEMA IA 10042-1 - Industrial Control and Systems Part 1: Electromechanical AC Transfer Switch Equipment; 2025.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 1008 - Transfer Switch Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate compatibility of transfer switches to be installed with work provided under other sections or by others.

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2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
4. Coordinate the work with placement of supports, anchors, etc. required for mounting.
5. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features.

1. Where applicable, include characteristic trip curves for overcurrent protective devices.

C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections.

1. Clearly indicate whether proposed short circuit current ratings are based on testing with specific overcurrent protective devices or time durations; indicate short-time ratings where applicable.

D. Specimen Warranty: Submit sample of manufacturer's warranty.

E. Evidence of qualifications for installer.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

G. Manufacturer's certification that products meet or exceed specified requirements.

H. Source quality control test reports.

I. Manufacturer’s detailed field testing procedures.

J. Field quality control test reports.

K. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

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L. Executed Warranty: Submit documentation of final executed warranty completed in CPL's name and registered with manufacturer.

M. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

N. Maintenance Materials: Furnish the following for CPL's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.6 QUALITY ASSURANCE

A. Comply with the following:

1. NFPA 70 (National Electrical Code).

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store transfer switches in accordance with manufacturer's instructions.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's instructions to avoid damage to transfer switch components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

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

B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

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PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Transfer Switches:

1. ABB: www.electrification.us.abb.com/#sle.
2. Eaton Corporation: www.eaton.com/#sle.
3. Generac Power Systems: www.generac.com/industrial/#sle.
4. Rehlko: www.powersystems.rehlko.com/#sle.
5. Schneider Electric; ASCO Power Technologies: www.ascopower.com/#sle.
6. Thomson Power Systems: www.thomsonps.com/#sle.
7. Substitutions: See Section 01 60 00 - Product Requirements.
8. Source Limitations: Provide transfer switches and accessories produced by single manufacturer and obtained from single supplier.

2.2 TRANSFER SWITCHES

A. Provide complete power transfer system consisting of all required equipment, conduit, boxes, wiring, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Integrated Transfer Switch/Connection Cabinet Units:

1. Provide integrated combination units also complying with Section 26 36 33 as indicated on the drawings.

D. Applications:

1. Utilize open transition transfer unless otherwise indicated or required.
2. Neutral Switching (Single Phase, Three Wire and Three Phase, Four Wire Systems):
    a. Unless otherwise indicated or required, provide solid (unswitched) neutral.

E. Construction Type: Either "contactor type" (open contact) or "breaker type" (enclosed contact) transfer switches complying with specified requirements are acceptable.

F. Manual Transfer Switch:

1. Voltage: As indicated on the drawings.
2. Ampere Rating: As indicated on the drawings.

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3. Neutral Configuration: Solid neutral (unswitched), except as indicated.
4. Load Served: As indicated on the drawings.
5. Primary Source: As indicated on the drawings.
6. Alternate Source: As indicated on the drawings.

G. Comply with NEMA IA 10042-1, and list and label as complying with UL 1008 for the classification of the intended application (e.g. emergency, optional standby).

H. Do not use double throw safety switches or other equipment not specifically designed for power transfer applications and listed as transfer switch equipment.

I. Load Classification: Classified for total system load (any combination of motor, electric discharge lamp, resistive, and tungsten lamp loads with tungsten lamp loads not exceeding 30 percent of the continuous current rating) unless otherwise indicated or required.

J. Switching Methods:

1. Open Transition:
    a. Provide break-before-make transfer without a neutral position that is not connected to either source, and with interlocks to prevent simultaneous connection of the load to both sources.
2. Neutral Switching: Either simultaneously switched neutral (break-before-make) or overlapping neutral (make-before-break) methods are acceptable.
3. Obtain control power for transfer operation from line side of source to which the load is to be transferred.

K. Service Conditions: Provide transfer switches suitable for continuous operation at indicated ratings under the service conditions at the installed location.

L. Enclosures:

1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
    a. Outdoor Locations: Type 3R or Type 4.
2. Provide lockable door(s) for outdoor locations.
3. Finish: Manufacturer's standard unless otherwise indicated.

M. Short Circuit Current Rating:

1. Withstand and Closing Rating: Provide transfer switches, when protected by the supply side overcurrent protective devices to be installed, with listed withstand and closing rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.

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N. Manual Transfer Switches:

1. Description: Transfer switches with manually initiated transfer between sources; mechanically operated and mechanically held.

2.3 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Perform production tests on transfer switches at factory to verify operation and performance characteristics prior to shipment. Include certified test report with submittals.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of transfer switches are consistent with the indicated requirements.

C. Verify that rough-ins for field connections are in the proper locations.

D. Verify that mounting surfaces are ready to receive transfer switches.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances and required maintenance access.

D. Provide required support and attachment in accordance with Section 26 05 29.

E. Install transfer switches plumb and level.

F. Unless otherwise indicated, mount floor-mounted transfer switches on properly sized 3 inch high concrete pad constructed in accordance with Section 03 30 00.

G. Provide grounding and bonding in accordance with Section 26 05 26.

H. Identify transfer switches and associated system wiring in accordance with Section 26 05 53.

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3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Prepare and start system in accordance with manufacturer's instructions.

C. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.4 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.5 PROTECTION

A. Protect installed transfer switches from subsequent construction operations.

END OF SECTION 26 36 00

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SECTION 26 36 33 - CONNECTION CABINETS FOR PORTABLE GENERATORS AND LOAD BANKS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Permanently installed connection cabinets/docking stations with provisions for temporary power connections to portable equipment.

1.2 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 36 00 - Transfer Switches.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 1008 - Transfer Switch Equipment; Current Edition, Including All Revisions.

E. UL 1773 - Termination Boxes; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate compatibility of products and installation with CPL-furnished portable generators/load banks.

2. Coordinate work to avoid placement of ductwork, piping, equipment, and other obstructions within dedicated equipment spaces and working clearances required by NFPA 70.

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3. Coordinate arrangement of equipment with dimensions and clearance requirements of actual equipment to be installed.
4. Coordinate work with placement of supports and anchors required for mounting.
5. Notify Engineer of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Preinstallation Meeting: Where applicable, conduct meeting with permanently installed generator manufacturer representative and installer to review proposed system configuration.

C. Where work involves interruption of existing electrical service, arrange service interruption with CPL.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features.

C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing factory and field connections.

D. Field quality control test reports.

E. Operation and Maintenance Data: Include detailed information on system operation, replacement parts, and recommended maintenance procedures and intervals.

F. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

1.6 QUALITY ASSURANCE

A. Comply with the following:

1. NFPA 70.
2. Applicable local codes.

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

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with power transfer systems of similar size, type, and complexity.

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1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store in clean, dry space. Maintain factory wrapping or provide additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's instructions to avoid damage to components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

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

B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide an integrated combination transfer switch/connection cabinet unit from a single manufacturer and obtained from a single supplier. See Section 26 36 00 - Transfer Switches for acceptable manufacturers.

2.2 CONNECTION CABINETS/DOCKING STATIONS

A. Description: Cabinets with provisions for temporary facility connection to portable generators and/or load banks.

B. General Requirements:

1. Listed as complying with UL 1008 or UL 1773.
2. Temporary Connectors:
    a. Camlocks: Single-pole, series 16; 400 A rated.

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b. Lugs: Single-pole, mechanical type.

3. Input Camlock Connections for Generator: For each row, provide five camlock connectors (one for each phase, one for neutral, and one for ground).

4. Camlock Connector Color Code:

a. 240 V and Below:

1) Phase 1: Black.

2) Phase 2: Red.

3) Phase 3, Where Required: Blue.

b. Neutral: White.

c. Ground: Green.

5. Equipment Ground: Bonded to enclosure.

6. Bus Bar:

a. Material: Tin-plated copper, unless otherwise indicated.

b. Provide permanent connection to facility with mechanical set screw lugs.

7. Neutral Configuration:

a. Input for Generator: 100 percent rated.

b. Output for Load Bank: No neutral.

8. Temporary Cable Provisions: Provide access wiring entry/exit for conductors, with no sharp edges that may come in contact with conductor insulation.

C. Enclosure:

1. Material: Aluminum.

2. NEMA EN 10250 Rating: Type 3R.

3. Front Door: Lockable; capable of securing connection cables when locked.

4. Temporary Cable Access Panel: Hinged plate for bottom entry, mechanically interlocked with front door.

5. Finish Color: Manufacturer's standard.

D. Short Circuit Current Rating: Where not specified, provide connection cabinet with listed short circuit current rating not less than available fault current at installed location as indicated on drawings.

E. Connection Cabinet:

1. Input/Output Configurations: Input for generator, male camlocks.

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2. Main Disconnect: No disconnect.
3. Ground: Minimum 25 percent rated.
4. Phase Poles: As indicated on drawings.
5. Ampere Rating: As indicated on drawings.
6. Voltage for Color Codes: As indicated on drawings.
7. Mounting Configuration: Wall mounted.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify field measurements.

B. Verify ratings and configurations of connection cabinets and associated components.

C. Verify locations of rough-ins for field connections.

D. Verify mounting surfaces are ready to receive connection cabinets.

E. Verify conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Comply with NECA 1 for general workmanship.

B. Install products in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances and required maintenance access; provide adequate space for temporary cable connections.

D. Provide required support and attachment; see Section 26 05 29.

E. Install connection cabinets plumb and level.

F. Unless otherwise indicated, mount floor-mounted connection cabinets on properly sized concrete pad 3 inches in height.

G. Provide grounding and bonding; see Section 26 05 26.

H. Provide identification; see Section 26 05 53.

1. Identify system wiring and components.
2. Connection Cabinets for Portable Generators:
    a. Use identification nameplate to identify phase rotation.

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b. Use warning label or identification nameplate to identify system bonding requirements in accordance with NFPA 70.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Test system operation.

C. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

D. Provide additional inspection and testing as required for completion of permanent engine generator testing as specified in Section 26 32 13.

E. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.4 CLEANING

A. See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.

B. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.5 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals for closeout submittals.

B. Demonstration: Demonstrate proper operation of connection cabinets and associated power transfer systems to CPL, and correct deficiencies or make adjustments as directed.

C. Training: Train CPL's personnel on operation, adjustment, and maintenance of connection cabinets and associated power transfer systems.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

3.6 PROTECTION

A. Protect installed connection cabinets from subsequent construction operations.

END OF SECTION 26 36 33

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SECTION 26 43 00 - SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surge protective devices for distribution locations.

1.2 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 24 16 - Panelboards.

1.3 ABBREVIATIONS AND ACRONYMS

A. EMI/RFI: Electromagnetic Interference/Radio Frequency Interference.

B. SPD: Surge Protective Device.

1.4 REFERENCE STANDARDS

A. MIL-STD-220 - Method of Insertion Loss Measurement; 2009c (Validated 2024).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 1283 - Standard for Electromagnetic Interference Filters; Current Edition, Including All Revisions.

G. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

1.5 ADMINISTRATIVE REQUIREMENTS

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A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Engineer of any conflicts or deviations from Contract Documents to obtain direction prior to ordering equipment.

1.6 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.

1. SPDs with EMI/RFI filter: Include noise attenuation performance.

C. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.

D. Certificates: Manufacturer's documentation of listing for compliance with the following standards:

E. Field Quality Control Test Reports.

F. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.

H. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in CPL's name and registered with manufacturer.

I. Project Record Documents: Record actual connections and locations of surge protective devices.

1.7 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

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

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.8 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in accordance with manufacturer's written instructions.

1.9 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.10 WARRANTY

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

B. Manufacturer's Warranty: Provide minimum five year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.

C. Exclude surge protective devices from any clause limiting warranty responsibility for acts of nature, including lightning, stated elsewhere.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Field-Installed, Externally Mounted Surge Protective Devices:

1. ABB: www.electrification.us.abb.com/#sle.
2. Intermatic, Inc: www.intermatic.com/#sle.
3. nVent ERICO: www.nvent.com/#sle.
4. Schneider Electric: www.se.com/#sle.
5. Surge Suppression, LLC (SSI): www.surgesuppression.com/#sle.

B. Factory-installed, Internally Mounted Surge Protective Devices:

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1. Same as manufacturer of equipment containing surge protective device, to provide complete listed assembly including SPD.

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

D. Source Limitations: Provide surge protective devices produced by single manufacturer and obtained from single supplier.

2.2 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS

A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.

B. Unless otherwise indicated, provide field-installed, externally-mounted or factory-installed, internally-mouonted SPDs.

C. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.

D. Protected Modes:

1. Wye Systems: L-N, L-G, N-G, L-L.

E. UL 1449 Voltage Protection Ratings (VPRs):

1. 208Y/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.

F. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.

G. Enclosure Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:

1. Indoor clean, dry locations: Type 1.

2. Outdoor locations: Type 3R.

H. Mounting for Field-installed, Externally Mounted SPDs: Unless otherwise indicated, as specified for the following locations:

1. Provide surface-mounted SPD where mounted in non-public areas or adjacent to surface-mounted equipment.

2. Provide flush-mounted SPD where mounted in public areas or adjacent to flush-mounted equipment.

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I. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.

1. Panelboards: See Section 26 24 16.

2.3 SURGE PROTECTIVE DEVICES FOR DISTRIBUTION LOCATIONS

A. Distribution locations include SPDs connected to distribution panelboards, motor control centers, and busway.

B. Surge Protective Device:

1. Protection Circuits: Field-replaceable modular or non-modular.
2. Surge Current Rating: Not less than 80 kA per mode/160 kA per phase.
3. Repetitive Surge Current Capacity: Not less than 3,500 impulses.
4. UL 1449 Nominal Discharge Current (I-n): 20 kA.
5. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
6. EMI/RFI Filtering: Provide EMI/RFI filter to attenuate electrical noise; listed as complying with UL 1283 for Type 2 SPDs (UL 1283 listing not available for Type 1 SPDs).
    a. Noise Attenuation: Not less than 40 dB at 100 kHz using MIL-STD-220 insertion loss test method.
7. Diagnostics:
    a. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.
    b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
    c. Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.
    d. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six digit LCD display that indicates quantity of surge events.
    e. Provide IP connectivity with BACnet or Modbus interface to indicate diagnostic events to the BMS. Refer to Section 23 09 23 - Direct-Digital Control System for HVAC and Section 23 09 13 Instrumentation and Control Devices for HVAC.

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PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.

C. Verify that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of drawings and manufacturer's instructions.

D. Verify system grounding and bonding is in accordance with Section 26 05 26, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide conductors with minimum ampacity as indicated on the drawings, as required by NFPA 70, and not less than manufacturer's recommended minimum conductor size.

E. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.

F. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 26 05 26 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

G. Disconnect SPD prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPD connected.

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3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS Section 7.19.1.

D. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

3.4 CLEANING

A. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 43 00

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SECTION 26 51 00 - INTERIOR LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Exit signs.

1.2 RELATED REQUIREMENTS

A. Section 26 05 29 - Hangers and Supports for Electrical Systems.

B. Section 26 05 33.16 - Boxes for Electrical Systems.

1.3 REFERENCE STANDARDS

A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).

B. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

D. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2025.

E. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

I. UL 1598 - Luminaires; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

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1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
4. Notify Engineer of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
2. Provide photometric calculations where luminaires are proposed for substitution.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

1. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.

D. Field quality control reports.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

G. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

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1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

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

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

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

B. Provide 3-year manufacturer warranty for LED luminaires, including drivers.

C. Provide 5-year pro-rata warranty for batteries for emergency luminaires.

D. Provide 10-year pro-rata warranty for batteries for self-powered exit signs.

PART 2 PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

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2.2 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.

1. LED Tape - General Requirements:

a. Listed.

b. Designed for field cutting in accordance with listing.

c. Wet Location Applications: IEC 60529, IP 68 (waterproof) rated.

H. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.3 EMERGENCY LUMINAIRES

A. Description: Emergency luminaires complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Each emergency luminaires shall be identical to its normal luminaire counterpart except for the inclusion of an integral battery pack and the associated UL 924 device.

C. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

D. Battery:

1. Size battery to supply all connected lamps, including emergency remote heads where indicated.

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E. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

F. Provide low-voltage disconnect to prevent battery damage from deep discharge.

G. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

2.4 EXIT SIGNS

A. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.

1. Number of Faces: Single- or double-face as indicated or as required for installed location.

2. Directional Arrows: As indicated or as required for installed location.

B. Powered Exit Signs: Internally illuminated with LEDs unless otherwise indicated.

1. Self-Powered Exit Signs:

a. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

b. Battery: Sealed, maintenance-free, nickel cadmium unless otherwise indicated.

c. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

d. Provide low-voltage disconnect to prevent battery damage from deep discharge.

e. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

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B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

E. Provide required support and attachment in accordance with Section 26 05 29.

F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

G. Suspended Ceiling Mounted Luminaires:

1. Do not use ceiling tiles to bear weight of luminaires.
2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
4. Secure pendant-mounted luminaires to building structure.
5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
6. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

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H. Recessed Luminaires:

1. Install trims tight to mounting surface with no visible light leakage.
2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

I. Suspended Luminaires:

1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet between supports.
4. Install canopies tight to mounting surface.
5. Unless otherwise indicated, support pendants from swivel hangers.

J. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

K. Install accessories furnished with each luminaire.

L. Bond products and metal accessories to branch circuit equipment grounding conductor.

M. Exit Signs:

1. Unless otherwise indicated, connect unit to unswitched power from circuit indicated. Bypass local switches, contactors, or other lighting controls.

N. Install lamps in each luminaire.

3.4 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Test self-powered exit signs, fluorescent emergency power supply units, and emergency luminaires to verify proper operation upon loss of normal power supply.

E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Engineer.

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3.5 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Engineer. Secure locking fittings in place.

B. Aim and position adjustable emergency luminaire lamps to achieve optimum illumination of egress path as required or as directed by Engineer or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Engineer or authority having jurisdiction.

3.6 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of luminaires to Engineer, and correct deficiencies or make adjustments as directed.

D. Just prior to Substantial Completion, replace all lamps that have failed.

3.8 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 26 51 00

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SECTION 26 56 00 - EXTERIOR LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Exterior luminaires.

1.2 RELATED REQUIREMENTS

A. Section 26 05 29 - Hangers and Supports for Electrical Systems.

B. Section 26 05 33.16 - Boxes for Electrical Systems.

1.3 REFERENCE STANDARDS

A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).

B. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2024.

C. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

E. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2000 (Reaffirmed 2006).

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 1598 - Luminaires; Current Edition, Including All Revisions.

H. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Notify Engineer of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

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1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

2. Provide photometric calculations where luminaires are proposed for substitution upon request.

3. Provide structural calculations for each pole proposed for substitution.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:

a. Include estimated useful life, calculated based on IES LM-80 test data.

2. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.

D. Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for the luminaires to be installed and comply with designated structural design criteria.

E. Field Quality Control Reports.

1. Include test report indicating measured illumination levels.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

G. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

H. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

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B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

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

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.8 WARRANTY

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

B. Provide 2-year manufacturer warranty for all LED luminaires, including drivers.

PART 2 PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.2 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

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E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

H. LED Luminaires:

1. Components: UL 8750 recognized or listed as applicable.
2. Tested in accordance with IES LM-79 and IES LM-80.
3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

I. LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.

1. LED Tape - General Requirements:
   a. Listed.
   b. Designed for field cutting in accordance with listing.
   c. Wet Location Applications: IEC 60529, IP 68 (waterproof) rated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

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B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.

B. Install products in accordance with manufacturer's instructions.

C. Install luminaires in accordance with NECA/IESNA 501.

D. Provide required support and attachment in accordance with Section 26 05 29.

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

G. Install accessories furnished with each luminaire.

H. Bond products and metal accessories to branch circuit equipment grounding conductor.

I. Install lamps in each luminaire.

3.4 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Engineer.

E. Measure illumination levels at night with calibrated meters to verify compliance with performance requirements. Record test results in written report to be included with submittals.

3.5 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Engineer. Secure locking fittings in place.

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3.6 CLEANING

A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of luminaires to Engineer, and correct deficiencies or make adjustments as directed.

D. Just prior to Substantial Completion, replace all lamps that have failed.

3.8 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 26 56 00

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SECTION 27 05 00 - COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 GENERAL

1.1 STANDARDS

A. The design and construction of the Communications, including without limitation all racks, pathways, terminations, cable management and maintenance areas shall conform to this division as well as the current

1. BICSI
    a. Telecommunications Distribution Methods Manual
    b. NECA/BICSI 607-2011 Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
2. IEEE standards
3. ANSI/EIA/TIA standards
    a. -568-C.0 Generic Telecommunications Cabling for Customer Premises
    b. -568-C.1 Commercial Building Telecommunications Cabling Standard
    c. -568-C.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standards
    d. -568-C.3 Optical Fiber Cabling Components
    e. -569- D Telecommunications Pathways and Spaces
    f. -606-B Administration Standard for Telecommunications Infrastructure Labeling shall be per the profile specified in this document.
4. NFPA 70, National Electrical Code
5. all applicable building codes.

PART 2 DESIGN

2.1 GROUNDING

A. The telecommunications ground buss in the SER or TE shall be bonded to building steel and the building electrical system per electrical codes and NECA/BICSI 607. All racks and conductive pathways shall be bonded to the T[M]GB ground.

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B. Cabling methods requiring solid grounding (e.g., SF/UTP Category 6A) shall have drain wire appropriately connected to the TGB either with listed grounding connectors or with appropriate active network hardware (e.g., shielded switches).

2.2 DOCUMENTATION

A. Faceplates

1. Each communications outlet shall have a unique Faceplate Number, per this section paragraph 2.5.G.1.

B. Wireless Access Points

1. Each Access Point shall have a unique AP Name.

C. Patching

1. The IT Contractor shall provide the Owner with a schedule spreadsheet for each TR, like Patch Table Template, of the horizontal cabling panels and housings in the scope of work. This schedule records the set of faceplate numbers and enables the integrator to assign each faceplate cable to a switch port.

2.3 PATHWAY AND DROP

A. All pathways shall be designed to facilitate periodic cable replacement with new cable types. All pathways shall be designed to cost-effectively enable future installation of fiber per paragraph 3.5. Other than backbone and risers amongst the TR, pathway penetrating fire-rated floor or wall shall utilize a mechanical firestop that does not require sealant, putty or removable pillows when changing cables. Product shall be EZ-Path

B. Conduit or innerduct must be used for each segment that is inaccessible. Each conduit segment may be no longer than 100’ and have no more than 180 degrees of bend, including offsets, between pull points. Conduit shall be sized for no more than 40% fill. When flexible pathway is used, that pathway is derated and one trade size larger installed. Flexible pathway must be secured to prevent deformation during pulling.

C. A unified structured cabling system that supports all compatible cables across all applications is preferred. Open cabling in a tray or basket that provides continuous support is preferred for accessible areas. Initial fill should not exceed 25%. When mechanically incompatible cables will be installed in a tray, divider(s) must be installed to separate the mechanically incompatible cable types. Cables that are electrically incompatible with the structured cables in an open tray must be installed in separate pathway with appropriate separation J-hooks are permitted when installed no more than 5ft apart and supporting no

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more than 50 cables. Recommended spacing is 4feet. Open cabling for fiber cables shall include innerduct for the fiber cables. Other types of intermittent supports are not permitted.

D. For each pathway containing fiber

1. Minimum bend radius is 2". Standard elbows are not permitted.
2. The structure shall provide continuous support, per manufacturer's recommendations, via cable tray, conduit, or inner-duct.
3. Fiber cables shall not be installed with non-fiber cables in undivided pathway larger in cross-section than 2" trade size. Exception: pathway serving a single faceplate.

E. Each drop shall be sized to accommodate the maximum number of cables that could be terminated on the faceplate cover installed. I.e. size the conduit by faceplate cover, not by the number of cables in the initial installation. See "Communications Horizontal Cabling" Table 1 for minimum trade size for a simple drop. Drops or poke-thru at the periphery shorter than 3 meters and with no more than 90 degrees of bend may exceed 40% fill, but shall not exceed 60% fill.

F. Each conduit shall enter an outlet, junction, or pull box per BISCI TDMM chapter on Horizontal Distribution Systems. I.e. near a corner of the box – not at the center of a face of the box. This maximizes the available bend radii for the contained cables.

2.4 OUTLET BOX

A. Each faceplate shall be mounted on a box eliminator with conduit support bracket, or outlet box as specified in "Communications Horizontal Cable" Table 1, with plaster ring for the single- or double-gang faceplate. For finished spaces, the box shall be installed behind the wall. Approved box eliminator products are Caddy MP1SCB and MP2SCB.

B. When retrofitting an older-style network faceplate on 6" outlet box (either surface mount or in-the-wall), supply and install a mud-ring or galvanized steel plate on the face of the existing box to transition to the required faceplate size. Any visible plate shall be painted the same paint color used to paint the surrounding wall.

C. When surface mounted pathway is preapproved by [U]Tech Design, the surface mounted pathway and box shall be steel with cross-sectional area at least equivalent to the trade sizes specified above and by BICSI. Pathway elbows, tees and fittings shall ensure that fiber cables' minimum radius requirements are satisfied. The product shall be Wiremold V series. Exception: Plastic pathway may be substituted above 7' AFF where the pathway is less subject to casual damage.

D. The outlet box shall be sized to accommodate the maximum number of cables allowed by the specified faceplate cover. The box dimensions shall allow space for the maximum number of

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faceplate device while accommodating the cable vendor ’s specified minimum bend radius, or 4 times the cable diameter, whichever is greater. The box depth shall not be less than 3 ”. The outlet box for a single or double cover shall be at least 70 cubic inches. When more than one faceplate is mounted on a single outlet box, no box face dimension shall be less than 4 ” and the box shall have a volume of no less than 35cu-in per faceplate gang.

E. Each faceplate should be installed with its bottom edge at least 16” AFF for ease of access and to keep short cable catenaries off of the floor. A faceplate shall not be installed with its bottom edge less than 4” AFF.

F. When an outlet box is not installed inside or flush to a wall, the box and its supporting structure shall provide the box with the structural integrity normally provided by a supporting wall. It shall also provide an aesthetic and safe surface on all exposed sides.

1. Structurally supported rigid or IMT conduit through the floor.
2. A sturdy outlet box with no sharp edges or knockouts.

G. Floor-mounted faceplates are permitted for systems furniture or similar where a wall-mounted faceplate is not practical. See drawings for details.

2.5 ADMINISTRATION AND IDENTIFICATION

A. General

1. Administration is Class 3 within each site.
2. Identifiers and labels shall be constructed per the specific profile defined within this section.

B. Telecommunications space

1. Each MDF and IDF shall be labeled inside, visible from the entrance door, with its space identifier (i.e., room number)
2. Each label referencing an entity in another building shall also include the canonical building name prefixed.

C. Rack

1. Each rack in a telecommunications space is assigned a unique Location Identifier bbb.k, where bbb is the containing space’s room identifier, and k is a single digit assigned from ascending numbers from left to right as viewed from the front of the equipment. I.e. racks 1, 2, 3, … from left to right.
2. Each rack shall be labeled at the top on both the front and rear with the rack portion of its location identifier in 48-point type.

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3. Each label referencing a rack shall include at least its location identifier. Each label referencing a rack outside of the TR shall also include its space identifier.

D. Patch Panel, termination block, or Housing

1. Each such panel is assigned a unique Panel Identifier bbb.k-rr, where bbb.k is the containing rack's location identifier, and rr is the two-digit rack unit number of the top of the specific panel. Rack unit numbers are assigned ascending from 1 at the useable bottom of the rack.
2. Each such panel shall be labeled on front and rear with its panel identifier in 24 point type.
3. Each label referencing a panel shall include its location identifier and panel identifier. Each label referencing a panel outside of its TR shall also include its space identifier.
4. Each named module, or range of named modules, shall be labeled with the module name of the remote end, including canonic building name if in another building. When a named module cannot be practically labeled, (e.g. high-density fiber terminations), the labeling may be on a cover spreadsheet in 10-point type on the housing cover.

E. Port(s) and position(s)

1. Port Identifiers for CAT panels do not incorporate module names.
    a. The port identifier consists of [bbb.]k-rr:P, where P is a consistent 2- or 3-digit port number. For a range of ports, the identifier consists of k-rr:P1-P2.
    b. Each e.g. CAT port shall be labeled with the unqualified (I.e. omit the bbb. prefix) port identifier of the remote port.
2. Port Identifiers for fiber panels/housing incorporate the module/cassette name as bbb.k-rr:m, where "m" is the module number (normally one of {A, B, C, D, E, F, …}) in that housing.
    a. The port identifier consists of [bbb.]rack-r:mP, where P is a consistent 2- or 3-digit port number. For a range of ports, the identifier consists of rack-r:mP1-P2.
    b. Each e.g. fiber port shall be labeled with the unqualified (I.e. omit the bbb. prefix) port identifier of the remote port, unless this information is in the module or cover label.

F. Active equipment

1. Provide CLEVNET with required port count of each type (standard, PoE, shielded, etc.).
2. Each chassis of active equipment shall be labeled in 18 point type with its equipmentName.
    a. equipmentName has two forms:

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1) For CLEVNET equipment with an IP address, label with its unqualified DNS name.

2) For equipment from foreign systems (AV, security, etc.), label with organization, contact info, and that organization's equipment identifier.

b. Each port on a piece of equipment is identified with a dotted notation as equipmentName.portNumber.

G. Faceplate

1. The top label of each faceplate contains the faceplate’s unique faceplate number, RRR-f, where RRR is the room number of the faceplate, and f is the ordinal number of the faceplate (sequential numbers starting from 1).

2. The bottom label of each faceplate contains the number of the TR for the faceplate's home run.

3. Jack positions shall be in the labels' corner(s) in clockwise order from top-left, depending on the quantity of jacks. Labeling shall be 12-point sans-serif font, or the largest smaller font that will fit on the label.

H. Cables

1. Each cable shall have a unique name consisting of sourceName “ / “ destinationName, where sourceName is the name of the upstream end and destinationName is the name of the downstream end. I.e. bbb.k-rr:P / RRR-f. Each cable shall be labeled at each end with an adhesive machine generated label with the name of the other end. The label for a cable between buildings shall include the far building name.

PART 3 EXECUTION

3.1 QUALIFICATION

A. Each installer shall have current certification by product manufacturer and/or BICSI

B. An apprentice or trainee may only assist a certified installer.

C. Contractor shall have a RCDD assigned to the project as Project Manager.

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3.2 INSTALLATION

A. All equipment and products shall be installed in accordance with the manufacturer's recommendations.

END OF SECTION 27 05 00

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SECTION 27 10 00 - STRUCTURED CABLING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Communications system design requirements.

B. Communications pathways.

C. Copper cable and terminations.

D. Communications outlets.

E. Communications grounding and bonding.

F. Communications identification.

1.2 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 33.16 - Boxes for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products.

E. Section 26 27 26 - Wiring Devices.

1.3 REFERENCE STANDARDS

A. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition; 2019.

B. ICEA S-90-661 - Category 3 and 5E Individually Unshielded Twisted Pairs, Indoor Cables (With or Without an Overall Shield) for Use in General Purpose and LAN Communication Wiring Systems; 2021.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set; 2024.

E. TIA-568.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards; 2018d, with Addenda (2020).

F. TIA-569 - Telecommunications Pathways and Spaces; 2019e, with Addendum (2022).

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G. TIA-606 - Administration Standard for Telecommunications Infrastructure; 2021d.

H. TIA-607 - Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2024e.

I. UL 444 - Communications Cables; Current Edition, Including All Revisions.

J. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

K. UL 1863 - Communications-Circuit Accessories; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate requirements for service entrance and entrance facilities with Communications Service Provider.

2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.

3. Coordinate arrangement of communications equipment with the dimensions and clearance requirements of the actual equipment to be installed.

4. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Arrange for Communications Service Provider to provide service.

C. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Communications Service Provider representative.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Sustainable Design Documentation: Submit manufacturer's product data on cable and cable insulation showing compliance with specified lead content requirements.

D. Shop Drawings: Show compliance with requirements on isometric schematic diagram of network layout, showing cable routings, telecommunication closets, rack and enclosure layouts and locations, service entrance, and grounding, prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).

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E. Evidence of qualifications for installer.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

G. Test Plan: Complete and detailed plan, with list of test equipment, procedures for inspection and testing, and intended test date; submit at least 60 days prior to intended test date.

H. Field Test Reports.

I. Project Record Documents: Prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).

1. Record actual locations of outlet boxes and distribution frames.
2. Show as-installed color coding, pair assignment, polarization, and cross-connect layout.
3. Identify distribution frames and equipment rooms by room number on drawings.

J. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of project record documents.

1.6 QUALITY ASSURANCE

A. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

B. Manufacturer Qualifications: At least 3 years experience manufacturing products of the type specified.

C. Installer Qualifications: A company having at least 3 years experience in the installation and testing of the type of system specified, and:

1. Employing a BICSI Registered Communications Distribution Designer (RCDD).
2. Supervisors and installers factory certified by manufacturers of products to be installed.
3. Employing BICSI Registered Cabling Installation Technicians (RCIT) for supervision of all work.

D. Products: Listed, classified, and labeled as suitable for the purpose intended.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

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1.7 DELIVERY, STORAGE, AND HANDLING

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

B. Keep stored products clean and dry.

1.8 WARRANTY

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

B. Correct defective Work within a 2 year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 SYSTEM DESIGN

A. Provide a complete permanent system of cabling and pathways for voice and data communications, including cables, conduits and wireways, pull wires, support structures, enclosures and cabinets, and outlets.

1. Comply with TIA-568 (SET) (cabling) and TIA-569 (pathways) (commercial standards).
2. Comply with Communications Service Provider requirements.
3. Provide fixed cables and pathways that comply with NFPA 70 and TIA-607 and are UL listed or third party independent testing laboratory certified.
4. Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F at relative humidity of 0 to 95 percent, noncondensing.
5. In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.

B. System Description:

1. Building Entrance Cable: By others.
2. Provide outlets where indicated on drawings.

C. Main Distribution Frame (MDF): Centrally located support structure for terminating horizontal cables that extend to telecommunications outlets, functioning as point of presence to external service provider.

1. Locate main distribution frame as indicated on the drawings.
2. Capacity: As required to terminate all cables required by design criteria plus minimum 25 percent spare space.

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D. Cabling to Outlets: Specified horizontal cabling, wired in star topology to distribution frame located at center hub of star; also referred to as "links".

2.2 PATHWAYS

A. Conduit: See section 260533.13; provide pull cords in all conduit and spare innerduct.

B. Underground Service Entrance: Rigid polyvinyl chloride (PVC) conduit, Schedule 40, Galvanized rigid steel conduit, or Intermediate metallic conduit (IMC).

C. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

1. Products:

a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built: www.holdrite.com/#sle.

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

2.3 COPPER CABLE AND TERMINATIONS

A. Manufacturers:

1. Belden: www.belden.com/#sle.

2. CommScope: www.commscope.com/#sle.

3. General Cable Technologies Corporation: www.generalcable.com/#sle.

4. Siemon Company: www.siemon.com/#sle.

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

B. Copper Backbone Cable:

1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568.2, ICEA S-90-661, and listed and labeled as complying with UL 444; arranged in 25-pair binder groups.

2. Cable Type: TIA-568.2 Category 3 UTP (unshielded twisted pair); 24 AWG.

3. Cable Capacity: Quantity of pairs as indicated on drawings.

4. Cable Applications:

a. Use listed NFPA 70 Type CMP plenum cable.

C. Copper Horizontal Cable:

1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568.2 and listed and labeled as complying with UL 444.

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2. Cable Type - Voice and Data: TIA-568.2 Category 6A UTP (unshielded twisted pair); 23 AWG.
3. Cable Capacity: 4-pair.
4. Cable Applications: Use listed NFPA 70 Type CMP plenum cable unless otherwise indicated.
5. Cable Applications:
    a. Slab on Grade Floor Boxes: Use indoor/outdoor plenum cable (listed UL 444 Type CMX Outdoor/CMP).
    b. All Other Applications: Use listed NFPA 70 Type CMP plenum cable.
6. Cable Jacket Color - Voice and Data Cable: Blue.

D. Copper Cable Terminations: Insulation displacement connection (IDC) type using appropriate tool; use screw connections only where specifically indicated.
1. Grounded shield when required for cable

E. Jacks and Connectors: Modular RJ-45, non-keyed, terminated with 110-style insulation displacement connectors (IDC); high impact thermoplastic housing; suitable for and complying with same standard as specified horizontal cable; UL 1863 listed.
1. Performance: 500 mating cycles.
2. Voice and Data Jacks: 8-position modular jack, color-coded for both T568A and T568B wiring configurations.

F. Copper Patch Cords:
1. Description: Factory-fabricated 4-pair cable assemblies with 8-position modular connectors terminated at each end.

2.4 COMMUNICATIONS OUTLETS

A. Manufacturers:
1. Belden: www.belden.com/#sle.
2. CommScope: www.commscope.com/#sle.
3. Siemon Company: www.siemon.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Outlet Boxes: Comply with Section 26 05 33.16.
1. Provide depth as required to accommodate cable manufacturer's recommended minimum conductor bend radius.

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2. Minimum Size, Unless Otherwise Indicated:
    a. Data or Combination Voice/Data Outlets: 4-11/16" square inch square by 2-1/8 inch deep (100 by 54 mm) trade size.

C. Wall Plates:
1. Comply with system design standards and UL 514C.
2. Accepts modular jacks/inserts.
3. Capacity: As indicated on drawings.
4. Wall Plate Material/Finish - Flush-Mounted Outlets: Match wiring device and wall plate finishes specified in Section 26 27 26.

2.5 GROUNDING AND BONDING COMPONENTS

A. Comply with TIA-607.

B. Comply with Section 26 05 26.

2.6 IDENTIFICATION PRODUCTS

A. Comply with TIA-606.

B. Comply with Section 26 05 53.

2.7 ACCESSORIES

A. Hook-and-Loop Cable Ties:
1. Description: Single-component, self-engaging fastener with hook on one side and engageable loop backing.
2. Cable Ties Installed in Spaces Used for Environmental Air: Fire retardant; plenum rated, listed as suitable for use in air-handling spaces.

2.8 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Factory test cables according to TIA-568 (SET).

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PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

A. Comply with latest editions and addenda of TIA-568 (SET) (cabling), TIA-569 (pathways), TIA-607 (grounding and bonding), BICSI N1, NFPA 70, and SYSTEM DESIGN as specified in PART 2.

B. Comply with Communication Service Provider requirements.

C. Grounding and Bonding: Perform in accordance with TIA-607 and NFPA 70.

D. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

3.2 INSTALLATION OF PATHWAYS

A. Install pathways with the following minimum clearances:

1. 48 inches from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.
2. 12 inches from power conduits and cables and panelboards.
3. 5 inches from fluorescent and high frequency lighting fixtures.
4. 6 inches from flues, hot water pipes, and steam pipes.

B. Outlet Boxes:

1. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of telecommunications outlets provided under this section.
    a. Mounting Heights: As indicated on the drawings.
    b. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
    c. Provide minimum of 24 inches horizontal separation between flush mounted outlet boxes installed on opposite sides of fire rated walls.
    d. Unless otherwise indicated, provide separate outlet boxes for line voltage and low voltage devices.
    e. Locate outlet boxes so that wall plate does not span different building finishes.
    f. Locate outlet boxes so that wall plate does not cross masonry joints.

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3.3 INSTALLATION OF EQUIPMENT AND CABLING

A. Cabling:

1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.
2. Do not over-cinch or crush cables.
3. Do not exceed manufacturer's recommended cable pull tension.
4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.

B. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:

1. At Distribution Frames: 120 inches.
2. At Outlets - Copper: 12 inches.

C. Copper Cabling:

1. Category 5e and Above: Maintain cable geometry; do not untwist more than 1/2 inch from point of termination.
2. For 4-pair cables in conduit, do not exceed 25 pounds pull tension.
3. Use T568B wiring configuration.

D. Identification:

1. Use wire and cable markers to identify cables at each end.
2. Use manufacturer-furnished label inserts, identification labels, or engraved wallplate to identify each jack at communications outlets with unique identifier.
3. Use identification nameplate to identify cross-connection equipment, equipment racks, and cabinets.

3.4 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Comply with inspection and testing requirements of specified installation standards.

C. Visual Inspection:

1. Inspect cable jackets for certification markings.
2. Inspect cable terminations for color coded labels of proper type.
3. Inspect outlet plates and patch panels for complete labels.

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4. Inspect patch cords for complete labels.

D. Testing - Copper Cabling and Associated Equipment:

1. Test backbone cables after termination but before cross-connection.
2. Test backbone cables for DC loop resistance, shorts, opens, intermittent faults, and polarity between connectors and between conductors and shield, if cable has overall shield.
3. Test operation of shorting bars in connection blocks.
4. Category 6 and Above:
    a. Wire map
    b. Length
    c. DC loop resistance
    d. RL and RL @ Remote
    e. Attenuation
    f. ACR and ACR @ Remote
    g. PSACR and PSACR @ Remote
    h. ELFEXT and ELFEXT @ Remote
    i. PSELFEXT and PSELFEXT @ Remote
    j. PSNEXT and PSNEXT @ Remote
    k. Delay skew
    l. Propagation delay

E. Final Testing: After all work is complete, including installation of telecommunications outlets, and telephone dial tone service is active, test each voice jack for dial tone.

END OF SECTION 27 10 00

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SECTION 27 11 00 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Communications cabinets, racks, frames, and enclosures.

B. Communications termination blocks and patch panels.

C. Communications cable management.

D. Communications rack-mounted power protection and distribution.

E. Communications uninterruptible power supply (UPS).

1.2 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 53 - Identification for Electrical Systems.

C. Section 27 10 00 - Structured Cabling.

1.3 ABBREVIATIONS AND ACRONYMS

A. PDU: Power distribution unit.

B. RCDD: Registered communications distribution designer.

C. UPS: Uninterruptible power supply.

1.4 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; current edition.

B. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition; 2019.

C. BICSI TDMM - Telecommunications Distribution Methods Manual, 15th Edition; 2024.

D. EIA/ECA-310 - Cabinets, Racks, Panels, and Associated Equipment; 2005e.

E. NECA 411 - Standard for Installing and Maintaining Uninterruptible Power Supplies (UPS); 2014.

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F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. TIA-568.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards; 2018d, with Addenda (2020).

H. TIA-568.3 - Optical Fiber Cabling and Components Standard; 2022e.

I. TIA-606 - Administration Standard for Telecommunications Infrastructure; 2021d.

J. TIA-607 - Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2024e.

K. UL 1363 - Relocatable Power Taps; Current Edition, Including All Revisions.

L. UL 1778 - Uninterruptible Power Systems; Current Edition, Including All Revisions.

M. UL 2416 - Audio/Video, Information and Communication Technology Equipment Cabinet, Enclosure and Rack Systems; Current Edition, Including All Revisions.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate requirements for communications entrance protection with Communications Service Provider.

2. Coordinate arrangement of equipment with dimensions and clearance requirements.

3. Notify Engineer of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.6 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product. Include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.

C. Shop Drawings: Include plan views indicating locations of equipment and proposed cable routing. Include elevations and details of proposed equipment arrangements, prepared and approved by BICSI RCDD.

D. Field quality control submittals.

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E. Operation and Maintenance Data: Include detailed information on system operation, equipment setup, replacement parts, and recommended maintenance procedures and intervals.

F. Field Test Reports.

G. Project Record Documents: Prepared and approved by BICSI RCDD.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Company having minimum 3 years of experience in installation and testing of type of system specified.

1. Employing BICSI RCDD.

2. Supervisors and installers factory certified by manufacturers of products to be installed.

B. Product Evaluation and Listing Organization Qualifications: Organization engaged in evaluation of products and services, including those recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL), and acceptable to authorities having jurisdiction.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.9 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.10 WARRANTY

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

B. Manufacturer Warranty: Provide manufacturer warranty for defects in material and workmanship for duration below. Complete forms in CPL's name and register with manufacturer.

1. Communications UPS with VRLA Batteries: 3 years.

2. Communications UPS with Lithium-ion Batteries: 5 years.

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PART 2 PRODUCTS

2.1 COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

A. Manufacturers:
   1. Belden: www.belden.com/#sle.
   2. Chatsworth
   3. CommScope: www.commscope.com/#sle.
   4. Siemon Company: www.siemon.com/#sle.

B. General Requirements:
   1. Component Racks: EIA/ECA-310 standard 19 inches wide, unless otherwise indicated.
   2. Listed as complying with UL 2416.
   3. Cabinets: Steel construction with corrosion resistant finish.
   4. Provide racks and shelves with static load rating suitable for supported loads.
   5. Locks: Keyed alike.

C. Floor-Mounted Racks: Aluminum or steel construction with corrosion resistant finish; vertical and horizontal cable management channels, top and bottom cable troughs, and grounding lug.

D. Accessories:
   1. 1U blanking panels, quantity 6.

2.2 COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

A. Copper Cross-Connection Equipment:
   1. Manufacturers:
      a. Belden: www.belden.com/#sle.
      b. CommScope: www.commscope.com/#sle.
      c. Siemon Company: www.siemon.com/#sle.
   2. Patch Panels for Copper Cabling: Sized to fit EIA/ECA-310 standard 19-inch wide equipment racks; 0.09-inch thick aluminum; cabling terminated on Type 110 insulation displacement connectors; printed circuit board interface.
      a. Jacks: Non-keyed RJ-45, suitable for and complying with same standard as cable to be terminated; maximum 48 ports per standard width panel.

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b. Comply with TIA-568.2.

c. Include provisions for both T568A and T568B wiring configurations.

d. Capacity: Provide ports sufficient for cables to be terminated plus 25 percent spare.

e. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606.

f. Provide incoming cable strain relief and routing guides on back of panel.

B. Fiber Optic Cross-Connection Equipment:

1. Manufacturers:

a. Belden: www.belden.com/#sle.

b. CommScope: www.commscope.com/#sle.

c. Corning

d. Siemon Company: www.siemon.com/#sle.

2. Patch Panels for Fiber Optic Cabling: Sized to fit EIA/ECA-310 standard 19-inch wide equipment racks; 0.09-inch thick aluminum.

a. Comply with TIA-568.3; match cable.

b. Adapters:

1) Maximum of 24 duplex adaptors per standard panel width.

c. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606.

d. Provide incoming cable strain relief and routing guides on back of panel.

e. Provide rear cable management tray at least 8-inches deep with removable cover.

f. Provide dust covers for unused adapters.

2.3 COMMUNICATIONS CABLE MANAGEMENT

A. Manufacturers:

1. Belden: www.belden.com/#sle.

2. CommScope: www.commscope.com/#sle.

3. Siemon Company: www.siemon.com/#sle.

B. Comply with BICSI TDMM for cable organization, minimizing strain relief, and cable bending limitations.

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C. Comply with TIA-607 and NFPA 70 for bonding of metal parts with dedicated wiring or by using listed connections.

D. Horizontal/Vertical Cable Managers: Compatible with equipment racks.

2.4 COMMUNICATIONS RACK-MOUNTED POWER PROTECTION AND DISTRIBUTION

A. Rack Mounted Power Protection:

1. Provide line- and low-voltage branch power protection.

B. Rack Power Strips:

1. Description: UL 1363 listed and labeled, industrial grade power strip.
2. Provide AC rack-mounted power taps for equipment loads.
3. Mounting Orientation: Horizontal.
4. Ratings: 120 V, 20 A.
5. Provide integral surge protection.
6. Number and Type of Load Receptacles: as required.
7. Cord Length: as required.

2.5 COMMUNICATIONS UNINTERRUPTIBLE POWER SUPPLY (UPS)

A. General Requirements:

1. Provide UPS-backed AC power to protect electronic equipment.
2. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15.
3. Listed and labeled as complying with UL 1778.
4. DC-Link Battery Energy Source: Lithium-Ion.

B. Design:

1. Rectifier/Charger Capacity: Sufficient to supply full load to inverter while recharging fully-discharged battery to 95 percent of full capacity in four hours or less; and within input current limits.
2. Provide means for online testing of UPS, including test points to allow adjusting and servicing. Provide means for testing while in bypass.
3. Mean Time Between Failures: 60,000 hours, minimum.
4. Cooling: Natural convection.

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5. Operate battery floating, isolated from UPS AC input and AC output. Battery may be resistance grounded through 5,000 to 10,000 ohms for purpose of ground fault sensing.
6. Do not use continuous moving parts or electron tubes. Accomplish power switching using semiconductor devices.
7. Construct equipment so that each power component can be replaced without soldering iron or special tools.
8. Use front-panel removable plug-in control modules.

C. System Ratings and Operating Characteristics:

1. Continuous Rating: As indicated on drawings, over entire battery voltage range at specified power factor. Maintain output voltage within specified limits at any load from no load to full load.
2. System Input:
   a. Voltage:
      1) Rating: 120 V, 1-phase.
      2) Operating Range: Plus/minus 10 percent.
   b. Current:
      1) Limit: Adjustable to maximum of 125 percent of that required to operate at full load with battery bank on float charge.
      2) Walk-in: 25 to 100 percent in fifteen seconds.
   c. Frequency Operating Range: 60 Hz, plus/minus 3 Hz.
   d. Power Factor: 74 to 100 percent, lagging, over full range of loads and input voltages.
   e. Harmonic Distortion of Input Current Wave Form: 5 percent maximum at full load.
3. Efficiency: ____ percent at full load, ____ percent at ____ percent load, minimum. Measure efficiency of unit including battery and isolation transformer losses.

D. Controls and Indicators:

1. Provide controls and indicators for monitoring UPS internal components and DC-Link.

2.6 ACCESSORIES

A. Backboards: Interior grade plywood without voids, 3/4-inch thick; listed and labeled as fire-retardant.

1. Do not paint over listing label.

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2.7 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify field measurements.

B. Verify ratings and configurations of system components.

C. Verify mounting surfaces are ready to receive system components.

D. Verify branch circuit wiring installation is completed, tested, and ready for connection to system where applicable.

E. Verify conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

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

B. Comply with BICSI N1.

C. Floor-Mounted Racks and Cabinets: Permanently anchor to floor in accordance with manufacturer's recommendations.

D. Communication UPS:

1. Comply with NECA 411.

2. Measure input/output voltages and make adjustments.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Comply with inspection and testing requirements of specified installation standards.

C. Provide equipment, tools, and supplies required to accomplish inspection and testing.

D. Measure input and output voltages and make appropriate adjustments.

E. Communications UPS: Test system in accordance with manufacturer's instructions.

F. Adjust settings as directed by CPL and CLEVNET.

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G. Submit detailed reports indicating inspection and testing results and corrective actions taken

3.4 CLEANING

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

B. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish; including repair of scratched or marred surfaces.

3.5 PROTECTION

A. Protect installed products from subsequent construction operations.

END OF SECTION 27 11 00

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SECTION 27 41 16 - INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Accessories

1.2 RELATED REQUIREMENTS

A. 27 10 00 - Structured Cabling: Use premises network infrastructure in addition to point-to-point Category cables for connecting equipment.

1.3 REFERENCE STANDARDS

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of A/V system with electrical and teledata systems.

B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Shop Drawings: Show compliance with requirements with schematic diagram of device layout, showing cable routings, A/V enclosure layouts, and connectivity, prepared certified designer.

D. Field Test Reports.

E. Designer's Qualification Statement.

F. Installer's Qualification Statement.

G. Maintenance Contracts.

H. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in CPL's name and registered with manufacturer.

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1.6 QUALITY ASSURANCE

A. Designer Qualifications: Contractor commissioning the digital media system shall hold a Crestron DigitalMedia Certified Engineer (DMC-E) certification..

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience. Technicians performing cable installation and termination shall hold a Crestron DigitalMedia Certified Technician (DMC-T) certification.

C. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

PART 2 PRODUCTS

2.1 ACCESSORIES

A. HDMI Wall Plate

1. Provide when fishing HDMI cable between the items in the display wall-mount and remote items such as the Owner-furnished workstation or simply a wall HDMI port.
2. Products:
    a. LeGrand C2G CG39710 HDMI Pass Through Decorative Wall Plate
    b. Substitutions: See Section 01 60 00-Product Requirements.

B. HDMI Cable: Products

1. C2G C2G10376
2. C2G C2G10456
3. Substitutions: See Section 01 60 00-Product Requirements.

PART 3 EXECUTION

3.1 INSTALLERS

A. Installer List: See Administrative Requirements in PART 1.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

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B. Connect system to meet performance requirements shown on drawings.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

3.4 QUALITY CONTROL - CATEGORY CABLE CERTIFICATION

3.5 SYSTEM TESTING AND COMMISSIONING

A. See Section 01 91 13 - General Commissioning Requirements, for commissioning requirements.

B. Testing

1. Contractor shall verify that all components of the system are installed according to manufacturers specifications and are compliant with Division 27 specifications.

3.6 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate operation of system to CPL's personnel.

3.7 PROTECTION

A. Protect installed equipment from subsequent construction operations.

END OF SECTION 27 41 16

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SECTION 27 51 16 - PUBLIC ADDRESS SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Amplifiers, controllers, and related equipment.

B. Input sources.

C. Speaker appliances.

D. Wire and cable.

1.2 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

1.3 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. BICSI TDMM - Telecommunications Distribution Methods Manual, 15th Edition; 2024.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 1480 - Standard for Speakers for Fire Alarm and Signaling Systems, Including Accessories; Current Edition, Including All Revisions.

F. UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Notify Engineer of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

2. Coordinate arrangement of equipment with dimensions and clearance requirements.

3. Coordinate colors of public address systems with required identification.

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4. Equipment:
    a. Coordinate power branch circuit protection and identification.
    b. Coordinate equipment cord-and-plug and receptacle configuration.
    c. Coordinate equipment POE requirements.
    d. Coordinate equipment monitoring requirements required for integration with building management system (BMS).
5. Framing and Supports:
    a. Coordinate sizes and arrangement of supports and bases with equipment and components.
    b. Coordinate work to provide additional framing and materials required for installation.
    c. Coordinate work with placement of supports and anchors required for mounting.
6. Coordinate work to avoid placement of ductwork, piping, equipment, diffusers, fire suppression system components, and other obstructions within spaces dedicated for public address systems.
7. Coordinate with communications equipment racks for equipment placements, cable management, and associated interconnections.
8. Coordinate associated communications cabling required for complete system capable of functions indicated.
9. Verify exact conduit termination locations required including boxes, enclosures, and equipment.

B. Preinstallation Meeting:
1. Convene one week prior to commencing work of this section. Review proposed construction staging, sequence of installation, and protection requirements for system.
2. Review anticipated noise levels compared to design estimations. Identify locations over 95 dB and confirm system design and planned installation considers intelligibility of messages for listeners.
3. Review microphone muting requirements with CPL prior to programming operating procedures.

C. Sequencing:
1. Perform field measurements prior to installation.
2. Conduct meeting with facility representative to review installation locations and requirements for interconnecting with indicated CPL systems.

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3. Verify naming convention for identification prior to creation of final drawings, reports, and labels.
4. Sequence work with affected installers to guard against damage.
5. Do not install devices or identification products until final surface finishes and painting are complete.
6. Do not locate ceiling speakers directly above devices with external microphones.
7. Do not point horns toward devices with external handsets used for paging.
8. Do not proceed with stages of work until above-ceiling inspections and corrections are complete.
9. Do not begin installation of communications cables until installation of conduit between termination points is complete.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data:

1. Provide manufacturer's standard catalog pages and data sheets for each system component.
2. Include ratings, configurations, standard wiring diagrams, outline dimensions, finishes, weights, service condition requirements, and installed features.

C. Shop Drawings:

1. Indicate electrical characteristics and connection requirements.
2. Indicate layout of equipment mounted in racks and cabinets, component interconnecting wiring, and wiring diagrams of field wiring to speakers and remote input devices.
3. Include dimensioned plan views indicating locations of system components, required clearances, attachment locations and details, and proposed size, type, and routing of conduits and/or cables.
4. Include system interconnection schematic diagrams and proposed arrangement of loudspeaker control zones.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Design Data:

1. Battery capacity and end-of-life runtime calculations.
2. Circuit and zone capacity calculations.

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F. Test Reports: Sound level survey.

G. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

H. Field quality control submittals.

I. Manufacturer's qualification statement.

J. Supplier's qualification statement.

K. Installer's qualification statement.

L. Maintenance contract.

M. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.

N. Specimen warranty.

O. Executed warranty.

P. Project Record Documents: Indicate actual locations of speakers, control equipment, and outlets for input/output connectors. Include final equipment settings and installed wiring arrangements/routing.

1.6 QUALITY ASSURANCE

A. Comply with the following:

1. ADA Standards.

2. NFPA 70.

3. Federal Communications Commission (FCC) requirements.

4. Applicable TIA/EIA standards.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with minimum 3 years years of documented experience.

C. Supplier Qualifications: Company specializing in supplying products specified in this section, with minimum 3 years years of documented experience; authorized by manufacturer.

D. Installer Qualifications: Company specializing in installing products specified in this section with minimum 3 years of documented experience.

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1. Contract maintenance office located within 200 miles of project site.

E. Maintenance Contractor Qualifications: Same entity as installer.

F. Product Evaluation and Listing Organization Qualifications: Organization engaged in evaluation of products and services, including those recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL), and acceptable to authorities having jurisdiction.

G. Documents at Project Site: Maintain at project site one copy of manufacturer's instructions and shop drawings.

1.7 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

B. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

C. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

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

B. Manufacturer Warranty: Provide 2-year manufacturer warranty. Complete forms in CPL's name and register with manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Valcom IP6000 Series.

B. Algo IP Paging Series.

C. Bogen Nyquist E700 Series.

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

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2.2 PUBLIC ADDRESS SYSTEM

A. Provide new public address system including required amplifiers, controllers, signal routing and processing equipment, input sources, speaker appliances, volume controls, component transformers, patch and I/O panels, wiring, supports, and other components necessary for meeting specified requirements in areas indicated on drawings.

B. System Description:

1. System is not emergency communications system.
2. Features:
    a. Interface to telephone system.

C. General Requirements:

1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Unless specifically indicated to be excluded, provide required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, and system programming, as necessary for complete operating system.
3. System Components Installed in Spaces Used for Environmental Air: Plenum rated; listed and labeled as complying with UL 2043, suitable for use in air-handling spaces.

D. Paging and Background Music Distribution:

1. Capable of distributing paging or background music signals simultaneously with and without interruption of signal.
2. For each amplifier or controller, provide separate volume and octave band equalization controls for paging and background music signals.

E. System Control and Monitoring:

1. Provide security features to prevent unauthorized changes to or loss of system control settings.
    a. Provide locked enclosure or cabinet for readily accessible electronic components.
    b. Provide password protection for access to programmable controls with means for backing up settings.

F. System Capacity:

1. Size amplifiers with 25 percent spare capacity.
2. Spare Speaker Appliance Circuit Capacity: 25 percent.
3. Secondary Power Source - Battery Storage Capacity: Provide standby operation sufficient for 24 hours.

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2.3 AMPLIFIERS, CONTROLLERS, AND RELATED EQUIPMENT

A. General Requirements:

1. Provide Class D efficiency equipment.
2. System Cabinet: Rack mounted; provide associated accessories.
3. Unless otherwise noted, select integrated touchscreen controllers when product selections are available.
4. Provide equipment compatible with public address system source inputs.
5. Provide capability to support redundant power supplies where indicated.
6. Microphone Inputs: Low impedance inputs with 600 microvolt sensitivity and noise level at least 55 dB below rated output.
7. Auxiliary Inputs: High impedance input with 0.4 V sensitivity and noise level at least 70 dB below rated output.

B. Amplifiers:

1. Two channels.
2. Configurable automatic gain.
3. Frequency Response: 50 to 15,000 Hz, plus/minus 2 dB.
4. Distortion: Less than 1.5 percent, 100 to 100,000 Hz at rated power.
5. Output Power: _____ Wrms.
6. Output: 4 ohms, 25 volts.
7. Include mic and line level inputs.

C. Controllers:

1. Support eight independent zones.
2. Routing of audio signals to appropriate zones.
3. Include ability for manual paging.
4. Master output volume and tone control.
5. Provide level of control for each input.
6. Bass: Plus 8 dB to minus 12 dB at 50 Hz.
7. Treble: Plus 8 dB to minus 12 dB at 10,000 Hz.
8. Program Selector: Provide program , listen-talk, and mode selector switches.

D. Digital Signal Processor (DSP):

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1. Include network interface for remote control and monitoring.
2. Channels:
    a. Input: _____, expandable to _____.
    b. Output: _____, expandable to _____.
3. Provide DSP for equalization, feedback suppression, signal delay, and routing.
4. Include multi-zone capability with adjustable signal delays.
5. Features allow adjustments to audio levels and clarity based on acoustics of each zone for intelligible audio.
6. Include messaging server for simultaneous paging across multiple zones.
    a. Allow announcements in one zone while other zones receive separate audio.
    b. User customizable priorities determine outcomes of simultaneous paging from multiple input sources.
7. Provide output expanders for enhanced DSP capabilities.

E. Equipment Racks: See Section 27 1100.

2.4 INPUT SOURCES

A. Telephone Interface: 600 ohm auxiliary input.
    1. VoIP paging interface or network adapter for phone integration.

2.5 SPEAKER APPLIANCES

A. General Requirements:
    1. Listed and labeled as complying with UL 1480.
    2. Listed as suitable for installed environment.
    3. Voltage: Field configurable and matched to audio distribution circuit voltage.
    4. Where in-plenum loudspeakers are used, adjust/relocate loudspeakers or use boot/attenuator to limit excessive transmission of sound through ceiling openings including, but not limited to, plenum air registers.

B. Loudspeakers: 8-inch coaxial speaker with integral crossover circuit.
    1. Manufacturers:
        a. Substitutions: See Section 01 60 00 - Product Requirements.

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2. Power Rating: 20 W.
3. Frequency Range: 45 to 18,000 Hz.
4. Sound Pressure Level: 95 dB at 3 feet with 1 W input.

2.6 WIRE AND CABLE

A. Microphone Cord: 20 AWG stranded copper conductor, 600 V insulation, rated 60 degrees C, two-conductor shielded cable with rubber jacket.

B. Input Source and Controller Cable: 22 AWG copper conductor, 300 V insulation, rated 60 degrees C, paired conductors twisted together, shielded, and covered with PVC jacket.

C. Speaker Wire and Cable: Copper conductor, 300 V insulation, rated 60 degrees C, paired conductors and covered with PVC jacket.
   1. Minimum Conductor Size: 16 AWG.
   2. Plenum Cable for Speaker Circuits: Rated 200 degrees C, paired conductors twisted together, shielded and covered with nonmetallic jacket; suitable for use for Class 2 circuits in air handling ducts, hollow spaces used as ducts, and plenums.

2.7 ACCESSORIES

A. Fire-Rated Speaker Enclosures:
   1. Manufacturers:
      a. Fire Rated Product Specialties Corp; _____: www.frpsonline.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Provide as required to preserve fire resistance rating of building elements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify field measurements.

B. Verify ratings and configurations of system components.

C. Verify mounting surfaces are ready to receive system components.

D. Verify branch circuit wiring installation is completed, tested, and ready for connection to system where applicable.

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E. Verify conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Comply with NECA 1 for general workmanship.

B. Install products in accordance with manufacturer's instructions.

C. Splice cable only in accessible junction boxes or at terminal block units.

D. Make cable shields continuous at splices and connect speaker circuit shield to equipment ground only at amplifier.

E. Install input circuits in separate cables and raceways from output circuits.

F. Leave 18 inches excess cable at each termination at microphone, volume pad, speaker, and other system outlet.

G. Leave 6 feet excess cable at each termination at system cabinet

H. Provide protection for exposed cables where subject to damage.

I. Use armored cable for outside speaker circuits.

J. Support cables above accessible ceilings to keep them from resting on ceiling tiles. Use spring metal clips or plastic cable ties to support cables from structure for ceiling suspension system. Include bridle rings or drive rings.

K. Use suitable cable fittings and connectors.

L. Connect reproducers to amplifier with matching transformers.

M. Install equipment racks in location shown; arrange to provide adequate ventilation and access.

N. Provide grounding and bonding; see Section 26 05 26.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.

C. Prepare and start system in accordance with manufacturer's instructions. Correct defective work and adjust for compliance with specified requirements.

D. Sound Level Survey:

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1. Measure and record sound power levels at designated locations, areas, or zones. Test with music and voice separately to confirm operation and make measurements.
2. Comply with BICSI TDMM coverage and intelligibility principles of design and acceptance testing.
3. Include sound level survey ambient noise levels measurements at quite and peak periods. Document on floor plan drawings noting amount of reverberation in given area and contained building furnishings or obstructions. Identify spaces with hard surfaces or absorption materials that may influence concentration of speakers.
4. Utilize "A" weighting scale on sound level meter with valid NICET equipment calibration certification.
5. Clearly indicate passed or failed area based on required technical parameters.
6. Record minimum and maximum sound pressure levels (SPLs) in areas with widely varying noise levels.
7. Review for system cross-talk and interference.

E. Adjust settings as directed by CPL.

F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.4 CLEANING

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

B. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.5 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of system to CPL, and correct deficiencies or make adjustments as directed.

B. Training: Train CPL's personnel on operation, adjustment, and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

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3.6 PROTECTION

A. Protect installed products from subsequent construction operations.

END OF SECTION 27 51 16

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SECTION 27 53 13 - CLOCK SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Clock system requirements.

B. IP Network clocks and accessories:

1. Power over Ethernet (PoE) network indicating clocks.
2. Network time server.

1.2 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 33.13 - Conduit for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; current edition.

B. IEEE 802.3 - IEEE Standard for Ethernet; 2022 (Corrigendum 2024).

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of clocks with potential conflicts and/or view obstructions installed under other sections or by others.
2. Coordinate the work with other installers to provide power for clocks and equipment at required locations.

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3. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Preinstallation Meetings:

1. Conduct meeting with facility representative to review clock and equipment locations.

2. Conduct meeting with facility representative and other related equipment manufacturers to discuss clock system interface requirements.

C. Sequencing:

1. Do not install clocks until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Software: One copy of software not resident in read-only memory.

1.6 QUALITY ASSURANCE

A. Comply with the following:

1. NFPA 70.

2. Applicable TIA/EIA standards.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

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

D. Installer Qualifications: Company with minimum three years documented experience with similar clock systems and providing contract maintenance service as a regular part of their business; manufacturer's authorized installer.

E. Maintenance Contractor Qualifications: Same entity as installer.

F. Products: Listed, classified, and labeled as suitable for the purpose intended.

G. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

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1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

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

B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.1 CLOCK SYSTEM REQUIREMENTS

A. Provide new clock system consisting of all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B, consumer application.

2.2 IP NETWORK CLOCKS

A. Power Over Ethernet (PoE) Network Indicating Clocks:

1. Manufacturers:

a. American Time: www.american-time.com/#sle.

b. Inova Solutions, Inc: www.inovasolutions.com/#sle.

c. Pyramid Time Systems; www.pyramidtimesystems.com/#sle.

d. The Sapling Company, Inc: www.sapling-inc.com/#sle.

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

2. Power Source: Power over Ethernet (PoE), in accordance with IEEE 802.3; provide PoE injectors as indicated or as required.

3. Time Reference Source: Network Time Protocol (NTP) server time data obtained via local area network (LAN); capable of time synchronization without master clock unit.

4. Analog Power Over Ethernet (PoE) Network Indicating Clocks:

a. Clock Movements: Microprocessor-controlled.

b. Clock Face:

1) Shape: Round.

2) Size: 12 inch, nominal.

3) Hands: For indicating hour, minute, and second.

c. Clock Crystal/Lens: Glass or shatter-resistant plastic.

d. Mounting: Surface.

B. Network Time Server:

1. Description: Microprocessor-based controller and associated accessories for maintaining time reference and correcting IP network indicating clocks connected to the same network.

2. Acceptable Time Reference Source(s): Based on Network Time Protocol (NTP) server time data obtained via local area network (LAN) or Global Positioning System (GPS) satellite antenna/receiver.

3. Features:

a. Battery backup for timekeeping and settings; rated for 10 years.

b. Supports security access control for system programming functions.

c. Supports remote interface via web browser or software.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that characteristics of system components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive system components.

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D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Wiring Method for NFPA 70 Class 2 and Class 3 Circuits: Unless otherwise indicated, use cables (not in conduit), where permitted by code.

1. Use suitable listed cables in wet locations, including underground raceways.
2. Use suitable listed cables for vertical riser applications.
3. Use listed plenum rated cables in spaces used for environmental air.
4. Install wiring in conduit for the following:
    a. Where required for rough-in.
    b. Where required by authorities having jurisdiction.
    c. Where exposed to damage.
    d. Where installed outside the building.
    e. For exposed connections from outlet boxes to devices.
5. Conduit: Comply with Section 26 05 33.13.
6. Conceal all cables unless specifically indicated to be exposed.
7. Route exposed cables parallel or perpendicular to building structural members and surfaces.
8. Do not exceed manufacturer's recommended maximum cable length between components.

D. Provide grounding and bonding in accordance with Section 26 05 26.

E. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

F. Identify system wiring and components in accordance with Section 26 05 53.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Prepare and start system in accordance with manufacturer's instructions.

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C. Program system parameters according to requirements of CPL.

D. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

E. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.4 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.5 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of system to CPL, and correct deficiencies or make adjustments as directed.

B. Training: Train CPL's personnel on operation, adjustment, and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

3.6 PROTECTION

A. Protect installed system components from subsequent construction operations.

END OF SECTION 27 53 13

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SECTION 28 10 00 - ACCESS CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Access control system requirements.

B. Access control units and software.

C. Access control point peripherals, including readers and keypads.

D. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware: Electrically operated door hardware, for interface with access control system.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 33.13 - Conduit for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 27 10 00 - Structured Cabling: Data cables for access control system IP network connections.

F. Section 28 20 00 - Video Surveillance (default): For interface with access control system.

G. Section 28 31 11 - Building Intrusion Detection: For interface with access control system.

1.3 DEFINITIONS

1.4 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 294 - Access Control System Units; Current Edition, Including All Revisions.

D. UL 1076 - Proprietary Burglar Alarm Units and Systems; Current Edition, Including All Revisions.

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1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other installers to provide suitable door hardware as required for both access control functionality and code compliance.
2. Coordinate the placement of readers with millwork, furniture, equipment, etc. installed under other sections or by others.
3. Coordinate the work with other installers to provide power for equipment at required locations.
4. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Preinstallation Meetings:

1. Conduct meeting with facility representative to review reader and equipment locations.
2. Conduct meeting with facility representative and other related equipment manufacturers to discuss access control system interface requirements.

1.6 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Include plan views indicating locations of system components and proposed size, type, and routing of conduits and/or cables. Include elevations and details of proposed equipment arrangements. Include system interconnection schematic diagrams. Include requirements for interface with other systems.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.

D. Design Data: Standby battery/UPS calculations.

E. Certify that proposed system design and components meet or exceed specified requirements.

F. Evidence of qualifications for manufacturer.

G. Evidence of qualifications for installer.

H. Evidence of qualifications for maintenance contractor (if different entity from installer).

I. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

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J. Manufacturer’s detailed field testing procedures.

K. Field quality control test reports.

L. Maintenance contracts.

M. Project Record Documents: Record actual locations of system components and installed wiring arrangements and routing.

N. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in CPL's name and registered with manufacturer.

O. Software: One copy of software not resident in read-only memory.

1.7 QUALITY ASSURANCE

A. Comply with the following:

1. NFPA 70.
2. The requirements of the local authorities having jurisdiction.
3. Applicable TIA/EIA standards.

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

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with access control systems of similar size, type, and complexity and providing contract maintenance service as a regular part of their business; authorized manufacturer's representative.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.9 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

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1.10 WARRANTY

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

B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Access Control Units - Basis of Design: Lenel S2.

B. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

C. Source Limitations: Where possible, furnish system components and accessories produced by single manufacturer and obtained from single supplier.

2.2 ACCESS CONTROL SYSTEM REQUIREMENTS

A. Provide new access control system consisting of required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. System Battery Backup: Provide batteries/uninterruptible power supplies (UPS) as required for 300 minutes full operation.

C. Access Control Points:

1. See drawings for locations of secured doors and their readers.
2. See article "ACCESS CONTROL POINT PERIPHERALS" below for device descriptions.

D. Computers Required:

1. See article "ACCESS CONTROL UNITS AND SOFTWARE" below for product descriptions.
2. Server(s):
    a. Quantity: One.
    b. Location(s): As indicated on drawings..

E. Interface with Other Systems:

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1. Provide products compatible with other systems requiring interface with access control system.
2. Interface with electrically operated door hardware as specified in Section 08 71 00.
3. Interface with intrusion detection system as specified in Section 28 31 11.
    a. Capable of affecting access for controlled doors for selected intrusion detection system events.
    b. Capable of affecting intrusion detection system status for selected access control system events.
4. Interface with video surveillance system as specified in Section 28 20 00.
    a. Capable of affecting camera/video operation for selected access control system events.

F. Provide products listed, classified, and labeled as suitable for the purpose intended.
1. Access Control Units and Readers: Listed and labeled as complying with UL 294.
2. Integrated Burglar Alarm/Access Control Equipment: Also listed and labeled as complying with UL 1076.

2.3 ACCESS CONTROL UNITS AND SOFTWARE

A. Provide access control units and software compatible with readers to be connected.

B. Unless otherwise indicated, provide software and licenses required for fully operational system.

C. Access Control Unit Basis of Design: Lenel S2 Netbox Node; https://buildings.honeywell.com/.

2.4 ACCESS CONTROL POINT PERIPHERALS

A. Provide devices compatible with control units and software.

B. Provide devices suitable for operation under the service conditions at the installed location.

C. Readers and Keypads:
1. General Requirements:
    a. Provide readers compatible with credentials to be used.
    b. Color: To be selected by Architect from manufacturer's available standard colors.
    c. Contactless Smart Card Readers:
        1) Utilize 13.56 MHz RF communication with compatible credentials.

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2) Utilize 64 bit authentication keys.

3) Support ISO compliant credentials.

4) Support data encryption.

2. Contactless Smart Card Reader - Basis of Design: HID Signo Series;

D. Door Position Switches:

1. Magnetic Contacts: Encapsulated reed switch(es) and separate magnet; designed to monitor opened/closed position of doors.

E. Door Locking Devices (Electric Strikes and Magnetic Locks): Comply with Section 08 71 00.

2.5 ACCESSORIES

A. Provide components as indicated or as required for connection of access control system to devices and other systems indicated.

B. Unless otherwise indicated, credentials to be provided by Owner.

C. Unless otherwise indicated, network switches required for network connections to system components to be provided CLEVNET.

D. Provide cables as indicated or as required for connections between system components.

1. Data Cables for IP Network Connections: Unshielded twisted pair (UTP), minimum Category 5e, complying with Section 27 10 00.

E. Provide accessory racks/cabinets as indicated or as required for equipment mounting.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings and configurations of system components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive system components.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to system.

E. Verify that conditions are satisfactory for installation prior to starting work.

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3.2 INSTALLATION

A. Install access control system in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Wiring Method: Unless otherwise indicated, use cables (not in conduit).

1. Use suitable listed cables in wet locations, including underground raceways.
2. Use suitable listed cables for vertical riser applications.
3. Use listed plenum rated cables in spaces used for environmental air.
4. Install wiring in conduit for the following:
    a. Where required for rough-in.
    b. Where required by authorities having jurisdiction.
    c. Where exposed to damage.
    d. Where installed outside the building.
    e. For exposed connections from outlet boxes to devices.
5. Conduit: Comply with Section 26 05 33.13.
6. Conceal cables unless specifically indicated to be exposed.
7. Use power transfer hinges complying with Section 08 71 00 for concealed connections to door hardware.
8. Cables in the following areas may be exposed, unless otherwise indicated:
9. Route exposed cables parallel or perpendicular to building structural members and surfaces.
10. Do not exceed manufacturer's recommended maximum cable length between components.

D. Provide grounding and bonding in accordance with Section 26 05 26.

E. Identify system wiring and components in accordance with Section 26 05 53.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Prepare and start system in accordance with manufacturer's instructions.

C. Program system parameters according to requirements of CPL.

D. Test for proper interface with other systems.

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E. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.4 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.5 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of system to CPL, and correct deficiencies or make adjustments as directed.

3.6 PROTECTION

A. Protect installed system components from subsequent construction operations.

END OF SECTION 28 10 00

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SECTION 28 20 00 - VIDEO SURVEILLANCE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Network (IP) cameras.

B. Video management software.

1.2 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 303 - Standard for Installing Closed-Circuit Television (CCTV) Systems; 2025.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate placement of cameras with structural members, ductwork, piping, equipment, luminaires, diffusers, fire suppression system components, and other potential conflicts.

2. Coordinate work to provide power for cameras and equipment at required locations.

3. Notify Engineer of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

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1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Include plan views indicating locations of system components and proposed size, type, and routing of conduits and/or cables. Include elevations and details of proposed equipment arrangements. Include system interconnection schematic diagrams. Include requirements for interface with other systems.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.

D. Installer's qualification statement.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

F. Field quality control test reports.

G. Project Record Documents: Record actual locations of system components and installed wiring arrangements and routing.

H. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

I. Executed warranty.

J. Software: One copy of software not resident in read-only memory.

1.6 QUALITY ASSURANCE

A. Comply with the following:

1. NFPA 70.
2. Applicable TIA/EIA standards.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions and NECA 303.

B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

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1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

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

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Axis Communications; www.axis.com/#sle.

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

C. Source Limitations: Where possible, furnish system components and accessories produced by single manufacturer and obtained from single supplier.

2.2 NETWORK (IP) CAMERAS

A. Provide cameras and associated accessories suitable for operation under service conditions at installed location. Provide additional components (e.g., enclosures, heaters, and blowers) as required.

B. Where not factory installed, provide additional components (e.g., lenses and mounting accessories) as necessary for complete installation.

C. Network (IP) Fixed Dome Panoramic Camera - Basis of Design: Axis Communications Model M4317-PLVE-PLE (Outdoor, IR illumination, Vandal-resistant); www.axis.com/#sle.

1. Maximum Video Resolution: 2160 x 2160.
2. Maximum Frame Rate: 50/60 fps at 50/60 Hz.
3. Image Sensor Size: 1/1.8 inch/6 MP.
4. Minimum Illumination/Light Sensitivity (Color): 0.16 lux.
5. Lens: 1.1 mm, F2.0; horizontal field of view of 182 degrees, vertical field of view of 182 degrees; fixed focus, fixed iris.

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6. Features: Zipstream, forensic capture wide dynamic range, local storage, Power over Ethernet (PoE), day and night functionality, built-in IR illumination, IP66/NEMA 4X/IK10 casing.

D. Network (IP) Fixed Dome Camera - Basis of Design: Axis Communications P32 Series; Model P3277-LV (IR illumination, Vandal-resistant); www.axis.com/#sle.

1. Maximum Video Resolution: 2592 x 1944.
2. Maximum Frame Rate: 25/30 fps at 50/60 Hz.
3. Image Sensor Size: 1/2.8 inch.
4. Minimum Illumination/Light Sensitivity (Color): 0.1 lux.
5. Lens: 3-8 mm, F1.3; horizontal field of view of 104-40 degrees; varifocal, P-Iris, remote focus and zoom.
6. Features: Zipstream, forensic capture wide dynamic range, Lightfinder, local storage, Power over Ethernet (PoE), day and night functionality, built-in IR illumination, image rotation (0, 90, 180, or 270 degrees), IP52/IK10 casing.

E. Network (IP) Fixed Dome Camera - Basis of Design: Axis Communications P32 Series; Model P3288-LVE (IR illumination, Vandal-resistant); www.axis.com/#sle.

1. Maximum Video Resolution: 3840 x 2160.
2. Maximum Frame Rate: 25/30 fps at 50/60 Hz.
3. Image Sensor Size: 1/1.8 inch.
4. Minimum Illumination/Light Sensitivity (Color): 0.1 lux.
5. Lens: 4.4-14.6 mm, F1.5; horizontal field of view of 103-29 degrees; varifocal, P-Iris, remote focus and zoom.
6. Features: Zipstream, forensic capture wide dynamic range, Lightfinder, local storage, Power over Ethernet (PoE), day and night functionality, built-in IR illumination, image rotation (0, 90, 180, or 270 degrees), IP52/IK10 casing.

F. Network (IP) Fixed Dome 360 Degree Multisensor Panoramic Camera - Basis of Design: Axis Communications P37 Series; Model P3737-PLE (Outdoor, IR illumination, Vandal-resistant); www.axis.com/#sle.

1. Maximum Video Resolution: 2592 x 1944.
2. Maximum Frame Rate: 25/30 fps at 50/60 Hz.
3. Image Sensor Size: 1/2.7 inch.
4. Minimum Illumination/Light Sensitivity (Color): 0.19 lux.

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5. Lens: 4 x 3.2-8.1 mm, F1.9-3.2; horizontal field of view of 108-140 degrees; varifocal, fixed iris.
6. Features: Zipstream, forensic capture wide dynamic range, Lightfinder, local storage, Power over Ethernet (PoE), day and night functionality, built-in IR illumination (four, individually controllable), image rotation (0, 90, 180, or 270 degrees), IP66/IP67/NEMA 4X/IK09 casing.

G. Network (IP) Fixed Dome 180 Degree Multisensor Panoramic Camera - Basis of Design: Axis Communications P38 Series; Model P3818-PVE (Outdoor, Vandal-resistant); www.axis.com/#sle.
1. Maximum Video Resolution: 5120 x 2560.
2. Maximum Frame Rate: 25/30 fps at 50/60 Hz.
3. Image Sensor Size: 4 x 1/2.8 inch.
4. Minimum Illumination/Light Sensitivity (Color): 0.16 lux.
5. Lens: 4 x 3.2 mm, F2.0; horizontal field of view of 180 degrees.
6. Features: Zipstream, forensic capture wide dynamic range, Lightfinder, local storage, Power over Ethernet (PoE), day and night functionality, IP66/IP67/NEMA 4X/IK10 casing.

H. Network (IP) Fixed Dome 180 Degree Multisensor Panoramic Camera - Basis of Design: Axis Communications P38 Series; Model P3827-PVE (Outdoor, Vandal-resistant); www.axis.com/#sle.
1. Maximum Video Resolution: 3712 x 1856.
2. Maximum Frame Rate: 25/30 fps at 50/60 Hz.
3. Image Sensor Size: 4 x 1/2.8 inch.
4. Minimum Illumination/Light Sensitivity (Color): 0.15 lux.
5. Lens: 4 x 3.3 mm, F2.0; horizontal field of view of 180 degrees.
6. Features: Zipstream, forensic capture wide dynamic range, Lightfinder, local storage, Power over Ethernet (PoE), day and night functionality, IP66/IP67/NEMA 4X/IK10 casing.

2.3 VIDEO MANAGEMENT SOFTWARE

A. Unless otherwise indicated, provide all software and licenses required for fully operational system.

B. Video Management System - Basis of Design: Milestone.
1. Capacity: Supports unlimited number of cameras, servers, and clients; up to 4 monitors per graphics card.

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2. Recording: Supports continuous, schedule, and event recording modes.
3. Video Search: Supports search by camera, date, and timeline; smart search, video scrubbing, and locking of priorizted recordings.
4. Features: H.264, H.265, MPEG-4, and Motion JPEG compression; dewarp support; PTZ control support; remote and mobile access via AXIS Camera Station Pro app; access control and cardholder management; object analytics.

2.4 ACCESSORIES

A. Camera Enclosures and Mounting Brackets:
   1. Where not factory installed, provide accessory camera enclosures suitable for operation under service conditions at installed location.
   2. Where not factory installed, provide accessory camera mounting brackets necessary for installation.

B. Provide components as indicated or as required for connection of video surveillance system to devices and other systems indicated.

C. Provide cables as indicated or as required for connections between system components.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install video surveillance system in accordance with NECA 1 (general workmanship) and NECA 303.

B. Install products in accordance with manufacturer's instructions.

C. Provide required support and attachment; see Section 26 05 29.

D. Provide grounding and bonding; see Section 26 05 26.

E. Identify system wiring and components; see Section 26 05 53.

3.2 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Prepare and start system in accordance with manufacturer's instructions.

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C. Adjust cameras to provide desired field of view and produce suitable images under all service lighting conditions.

D. Program system parameters according to requirements of CPL.

E. Test for proper interface with other systems.

F. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

3.3 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.4 CLOSEOUT ACTIVITIES

3.5 PROTECTION

A. Protect installed system components from subsequent construction operations.

END OF SECTION 28 20 00

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SECTION 28 31 11 - BUILDING INTRUSION DETECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Intrusion detection system requirements.

B. Alarm control units and accessory equipment.

C. Initiating devices.

D. Alarm notification appliances.

1.2 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 08 71 00 - Door Hardware: Electrically operated locks and door holder devices to be monitored and controlled by intrusion detection system.

C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

D. Section 26 05 33.13 - Conduit for Electrical Systems.

E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

F. Section 28 10 00 - Access Control: For interface with intrusion detection system.

G. Section 28 20 00 - Video Surveillance (default): For interface with intrusion detection system.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 634 - Connectors and Switches for Use with Burglar-Alarm Systems; Current Edition, Including All Revisions.

D. UL 639 - Intrusion-Detection Units; Current Edition, Including All Revisions.

E. UL 1610 - Central-Station Burglar-Alarm Units; Current Edition, Including All Revisions.

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1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate compatibility of devices for the installed locations with work provided under other sections or by others.
2. Coordinate the placement of sensors and keypads with millwork, furniture, equipment, etc. installed under other sections or by others.
3. Coordinate the work with other installers to provide communication lines required for alarm control unit connection to central station.
4. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Preinstallation Meeting: Conduct meeting with facility representative and other related equipment manufacturers to discuss intrusion detection system interface requirements.

C. Sequencing:

1. Do not install sensors and keypads until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.

C. Shop Drawings: Include plan views indicating locations of system components and proposed size, type, and routing of conduits and/or cables. Include system interconnection schematic diagrams. Include requirements for interface with other systems.

D. Design Data: Include standby battery calculations.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

F. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.

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G. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in CPL's name and registered with manufacturer.

H. Project Record Documents: Record actual locations of system components and installed wiring arrangements and routing.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with intrusion detection systems of similar size, type, and complexity and providing contract maintenance service as a regular part of their business; authorized representative of control unit manufacturer.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

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

B. Provide minimum two year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

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PART 2 PRODUCTS

2.1 INTRUSION DETECTION SYSTEM REQUIREMENTS

A. Intrusion detection system shall be integrated into Lenel S2 access control system. Provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Alarm Control Unit: See 28 10 00 - Access Control. Located as indicated.

C. Initiating Device Requirements:

1. Protected Premises: Entire building as indicated.
2. Provide magnetic contacts to monitor opened/closed position for:
    a. All perimeter doors and windows.
    b. All roof access doors and hatches.
    c. All overhead doors.
    d. All perimeter hatch doors (e.g. compactor hatches).
3. Motion detection shall be provided by signal from video surveillance system to Lenel S2 system.
4. Provide glass break detectors to monitor:
    a. Staff room perimeter windows.

D. Alarm Notification and Reporting Requirements:

1. Transmit alarm report to listed remote central station under contract with facility.
    a. Primary Communication Means: Internet/intranet (IP addressing).
    b. Secondary Communication Means: Digital cellular communications.

E. Interface with Other Systems:

1. Provide products compatible with other systems requiring interface with intrusion detection system.
2. Interface with access control system as specified in Section 28 10 00.
    a. Capable of affecting access for designated doors for selected intrusion detection system events.
    b. Capable of affecting intrusion detection system status for selected access control system events.

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3. Interface with video surveillance system as specified in Section 28 20 00.
    a. Capable of activating video surveillance system and controlling camera inputs/video outputs for selected intrusion detection system events.
4. Interface with electrically operated door hardware as specified in Section 08 71 00.
    a. Capable of locking/unlocking/releasing designated doors for selected intrusion detection system events.

F. Provide products listed, classified, and labeled as suitable for the purpose intended.
1. Central Station Alarm Units: Listed and labeled as complying with UL 1610.

G. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B, consumer application.

2.2 ALARM CONTROL UNITS AND ACCESSORY EQUIPMENT

A. Manufacturers:
1. Bosch Security Systems, LLC: www.boschsecurity.us/#sle.
2. Substitutions: Not Permitted.

B. Alarm Control Panel: Modular construction.
1. Enclosure: Lockable; provide tamper protection.
2. Power Supply:
    a. Primary Power: 120 VAC; provide suitable transformer/power supply; supervised for loss of AC power.
    b. Secondary Power: Standby battery; provide suitable capacity for minimum standby time required by listing requirements, applicable codes, and authority having jurisdiction, but not less than four hours; provide suitable battery charger; supervised for low battery condition; protected from accidental reversal of battery leads.

C. Alarm Initiating Circuits: Supervised.
1. Hardwired Zones: Supports both normally closed and normally open conventional (non-addressable) initiating devices.

D. Alarm Notification Circuits: Supervised.

E. Communications Interfaces: Supervised.
1. Supports system reporting to central station receivers via integral interface or accessory interface modules using:

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a. Telephone lines.

b. Digital cellular network.

c. Internet/intranet (IP addressing).

F. Keypads: Supervised.

1. Provide interface to alarm control unit for system control and remote annunciation.

2. Provide visual notification of system status and zone information.

3. Provide audible notification to indicate system status, entry/exit delay, and alarm situations; provide separate distinguishable sounds for alarm and trouble conditions.

4. Keypad Type: Only LCD or graphic touch screen keypads are acceptable. Do not use LED keypads.

a. Graphic Touch Screen Keypads: Displays system status and zone information using plain English on graphic display; touch screen interface.

b. LCD Keypads: Displays system status and zone information using plain English on alphanumeric display; illuminated keys.

G. Peripheral Devices: Supervised; provide tamper protection.

H. Output Relays:

1. Relay Modules: Form C relays (normally open and normally closed); provide tamper protection.

2. Programmable to respond to system events, according to defined scheduling, or by manual activation from keypad.

I. User Codes:

1. Each user code to be individually assignable to any defined authority level for configurable access to system features and functions.

J. Scheduling:

1. Provide time/calendar-based scheduling capability for automated system control.

2. Supports open/close schedules for control of arming/disarming and reporting.

3. Supports timed events including, but not limited to:

a. Point bypass/unbypass.

b. Relay activate/deactivate.

K. Event Log:

1. Stores system events including time, date, partition, zone, and user code where applicable.

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2. Supports viewing of event log on keypads.

2.3 INITIATING DEVICES

A. Manufacturers: Same as manufacturer of alarm control units where possible.

B. General Requirements:

1. Provide devices suitable for intended application and location to be installed.

2. Outdoor Units: Weather resistant, suitable for outdoor use.

C. Contacts:

1. Listed and labeled as complying with UL 634.

2. Magnetic Contacts: Encapsulated reed switch(es) and separate magnet; designed to monitor opened/closed position of doors or windows.

a. Use standard security contacts (not balanced magnetic type) unless otherwise indicated.

3. Contact Color: To be selected by Architect from manufacturer's available standard colors.

D. Glass Break Detectors:

1. Listed and labeled as complying with UL 639.

2. Suitable for the glass type to be monitored.

3. Accurately discriminates false alarms from true glass break events.

4. Furnished with selectable sensitivity.

5. Acoustic/Shock Dual Technology Glass Break Detectors: Designed to detect breaking glass using a combination of ambient sound and vibration analysis.

2.4 ALARM NOTIFICATION APPLIANCES

A. Manufacturers: Same as manufacturer of alarm control units where possible.

B. Provide alarm notification appliances suitable for connection to control unit outputs.

C. Outdoor Units: Weather resistant, suitable for outdoor use.

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2.5 ACCESSORIES

A. Provide components as indicated or as required for connection of alarm control unit to devices and other systems indicated.

B. Provide cables as indicated or as required for connections between system components.

C. Provide end-of-line resistors (EOLR) as required for supervision of hardwired zones.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings and configurations of system components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive system components.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to system.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Wiring Method: Unless otherwise indicated, use wiring in conduit.

1. Conduit: Comply with Section 26 05 33.13.
2. Cables in the following areas may be exposed, unless otherwise indicated:
    a. Equipment closets.

D. Provide grounding and bonding in accordance with Section 26 05 26.

E. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

F. Identify system wiring and components in accordance with Section 26 05 53.

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3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Prepare and start system in accordance with manufacturer's instructions.

C. Inspection and testing to include, at a minimum:

1. Test each initiating device for proper response by alarm control unit.

a. Test glass break detectors using only manufacturer's recommended glass break simulation test units.

2. Test for proper operation of alarm notification appliances.

3. Test for proper operation of output relays.

4. Test for proper operation of communication interfaces and central station reporting.

5. Test for proper interface with other systems.

D. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.4 ADJUSTING

A. Program system parameters according to requirements of CPL.

3.5 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.6 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of system to CPL, and correct deficiencies or make adjustments as directed.

B. Training: Train CPL's personnel on operation, adjustment, and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

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3.7 PROTECTION

A. Protect installed system components from subsequent construction operations.

END OF SECTION 28 31 11

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SECTION 28 46 00 - FIRE DETECTION AND ALARM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire alarm system and associated components, including control units, related equipment, initiating devices, and notification appliances.

1.2 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: For non-power-limited cables.

B. Section 26 05 33.16 - Boxes for Electrical Systems.

1.3 ABBREVIATIONS AND ACRONYMS

A. AHJ: Authorities having jurisdiction.

B. BAS: Building automation system.

C. DMNS: Distributed mass notification system.

D. ECS: Emergency communications system.

E. EoL: End-of-line.

F. EVACS: Emergency voice/audio communication systems.

G. FACU: Fire alarm control unit.

H. HVAC: Heating, ventilation, and air conditioning.

I. IDC: Initiating device circuit.

J. LAN: Local area network.

K. MNS: Mass notification system.

L. NAC: Notification appliance circuit.

M. NPLFA: Non-power-limited fire alarm.

N. PLFA: Power-limited fire alarm.

O. SLC: Signaling line circuit.

P. SOO: Sequence of operation.

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1.4 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

D. NECA 90 - Standard for Commissioning Building Electrical Systems; 2015.

E. NECA 305 - Standard for Fire Alarm System Job Practices; 2018.

F. NFPA 3 - Standard for Commissioning of Fire Protection and Life Safety Systems; 2024.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

I. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

J. UL 38 - Standard for Manual Signaling Boxes for Fire Alarm Systems; Current Edition, Including All Revisions.

K. UL 268 - Standard for Smoke Detectors for Fire Alarm Systems; Current Edition, Including All Revisions.

L. UL 268A - Standard for Smoke Detectors for Duct Application; Current Edition, Including All Revisions.

M. UL 464 - Standard for Audible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories; Current Edition, Including All Revisions.

N. UL 864 - Control Units and Accessories for Fire Alarm Systems; Current Edition, Including All Revisions.

O. UL 1971 - Standard for Signaling Devices for the Hearing Impaired; Current Edition, Including All Revisions.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate arrangement of equipment with dimensions and clearance requirements of actual equipment.

2. Coordinate placement of devices and notification appliances with potential conflicts or view obstructions.

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3. Coordinate work to provide power for equipment at required locations (e.g., smoke dampers, type of actuators, line or local control transformer, zoning, grouping and circuit activations).
4. Coordinate requirements for branch circuit protection, identification, and shunt trip if applicable.
5. Coordinate fire alarm system detection and requirements for battery energy storage spaces.
6. Coordinate reflected ceiling plans to avoid conflicting placements; maintain minimum diffuser and detector clearances as indicated.
7. Coordinate submittals to confirm equipment and associated components are capable of indicated settings, and manufacturer documentation identifies required compatible product listings.
8. Notify Engineer of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
9. Lighting Controls: See Division 26.
10. Non-Power-Limited Cables: See Section 26 05 19.

B. Preinstallation Meetings:

1. Conduct meeting with facility representative to review devices, notification appliances, and equipment locations.
2. Conduct meeting with facility representative and other related equipment manufacturers to discuss fire alarm system interface requirements.
3. Conduct meeting to review anticipated installation of code-required smoke control requirements, product solutions, and SOO.
4. Convene one week before starting work for review of documented SOO for system applications.

C. Sequencing:

1. Verify exact termination locations required for boxes, enclosures, and equipment.
2. Do not install devices or notification appliances until final surface finishes, painting, and cleaning are complete, unless otherwise required by AHJ.
3. Do not begin installation of conductors and cables until installation of conduit and pathways between termination points is complete.
4. Sequence work to protect cabling (e.g., overspray painting, physical stress, and insulation damage or covering markings).

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5. Verify naming convention for equipment identification, including room names and numbers, prior to creation of final drawings, reports, and labels.

D. Scheduling:

1. Arrange access to facility for data collection with facility representative.

2. Where work involves interruption of existing electrical or fire alarm system service, arrange interruption with CPL.

a. Arrange test start and end with responsible reporting service. Confirm system normal operating mode and record as-found and as-left settings.

b. Arrange work to disable individual devices or circuits for minimal disruption if possible.

c. Arrange in accordance with NFPA 72 fire alarm system impairment requirements.

d. Where required by AHJ, arrange systems or partial system out of service interruption in accordance with requirements of building, life safety, and fire codes (e.g., approved fire watch plus required notifications, tags at each fire department connection and control valve, and AHJ notification when excess hours).

1.6 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Evidence of designer qualifications.

C. Comply with NFPA 72 chapter "Documentation," including noting names of installers, owners, and system classification information.

D. Design Documents: Submit all information required for plan review and permitting by AHJ, including floor plans, riser diagrams, and description of operation.

1. Copy (if any) of list of data required by AHJ.

2. NFPA 72 "Record of Completion", filled out to extent known at time.

3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A, and complete listing of software required.

4. Manufacturer's detailed product data sheet for each component, including wiring diagrams, and circuit length limitations. Catalog pages and product descriptions include ratings, dimensions, finishes, service conditions, and included features.

5. Certification by manufacturer of FACU that system design complies with Contract Documents.

6. Certification by Contractor that system design complies with Contract Documents.

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E. Shop Drawings: Submit installation documentation required for plan review and permitting by AHJ, including floor plans showing locations of fire alarm system components, enlarged drawn to identified scale plan view, and riser diagrams.

1. System zone boundaries and interfaces to fire safety systems.
2. Show locations of components, circuits, and raceways; mark components with identifiers used in control unit programming.
3. Include elevations and details of proposed equipment arrangements.
4. Include system interconnection schematic riser diagram showing proposed and approved cable size and type; coordinated with floor plans and describing circuit class, survivability, and application specific information required by NFPA 72.
5. Include typical wiring diagrams for devices, notification appliances, remote indicators, annunciators, remote test stations, and EoL and power supervisory devices.
6. Include requirements and control diagrams for interfacing with other systems.
7. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; standby and spare capacity calculations; notification appliance circuit loop resistance and voltage drop calculations, including spare capacity.
8. List of devices and notification appliances on each SLC, with spare capacity indicated.
9. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
10. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
11. Detailed drawing of graphic annunciators, displays, and interfaces.
12. Certification by either FACU manufacturer or manufacturer of related equipment.
13. Certification by FACU manufacturer that system design complies with Contract Documents.
14. Certification by Contractor that system design complies with Contract Documents.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Evidence of installer qualifications.

H. Evidence of maintenance contractor qualifications, if different from installer.

I. Inspection and Test Reports:

1. Submit inspection and test plan prior to closeout demonstration.

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2. Submit documentation of satisfactory inspections and tests.
3. Submit NFPA 72 "Inspection and Test," filled out.

J. Operating and Maintenance Data: See Section 01 7800 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
1. Complete set of specified design documents, as approved by AHJ.
2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
4. List of recommended spare parts, tools, and instruments for testing.
5. Replacement parts list with current prices, and source of supply.
6. Detailed troubleshooting guide and large scale input/output matrix.
7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to CPL.
8. Detailed but easy to read explanation of procedures require recording of system trouble events by qualified personnel, such as when routine testing is being conducted for fire drills and when entering into contracts for building renovations.

K. Project Record Documents: See Section 01 7800 for additional requirements, have one set available during closeout demonstration:
1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
2. "As installed" wiring and schematic diagrams, with final terminal identifications.
3. "As programmed" operating sequences, including control events by device, and updated input/output chart.

L. Closeout Documents:
1. Certification by manufacturer that system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
2. NFPA 72 "Record of Completion," filled out completely and signed by installer and authorized representative of AHJ.
3. Certificate of Occupancy.
4. Maintenance contract.
5. Report on training results.

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1.7 QUALITY ASSURANCE

A. Copies of Design Criteria Documents: For duration of project, maintain at project site copy of each referenced document that prescribes execution requirements; bound together. Also, NFPA 72, relevant portions of other applicable codes, and instructions and guidelines of AHJ. Include in submittals upon completion.

B. Designer Qualifications: NICET Level III (three) certified fire alarm technician or registered fire protection engineer, employed by FACU manufacturer, Contractor, or installer.

C. Installer Qualifications: Firm with minimum three years documented experience installing fire alarm systems of specified type and providing contract maintenance service as regular part of their business.

1. Authorized representative of FACU manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
2. Installer Personnel: At least two years of experience installing fire alarm systems.
3. Supervisor: Level III (three) certified fire alarm technician; furnish name and address.

D. Manufacturer Qualifications: Company specialized in manufacturing products specified in this section with at least three years of documented experience.

E. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

F. Product Evaluation and Listing Organization Qualifications: Organization engaged in evaluation of products and services, including those recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL), and acceptable to AHJ.

1.8 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

B. Receive, inspect, handle, and store products in accordance with manufacturer's instructions and NECA 305.

C. Handle carefully to avoid damage to internal components, enclosure, and finish.

D. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

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1.9 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

B. Do not exceed maximum ambient temperature requirements for batteries at any time, which reduces battery service life. Replace batteries exposed to temperatures in excess of manufacturer's requirements.

C. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Engineer and obtain direction before proceeding with work.

D. Existing Conditions:

1. Existing Fire Alarm System: Remove existing components indicated and incorporate remaining components into new system. Comply with NFPA 70.

    a. Maintain existing under warranty as if new; do not take existing portions of system out of service until new portions are fully operational, tested, and connected.

2. Modifications to Existing System:

    a. Remove inactive or abandoned cables and components from existing fire alarm system.

    b. Remove unused existing components and materials from site and dispose according to local and federal requirements.

    c. Remove accessible portion of abandoned cables unless tagged with identification product suitable to withstand based on installed environment.

1.10 WARRANTY

A. Fire Alarm Control Units and Accessory Equipment: Provide minimum 3-year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

B. Fire Alarm Manual Pull Stations: Provide minimum 1-year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

C. Fire Alarm System Detectors: Provide minimum 1-year year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

D. Fire Alarm System Notification Appliances: Provide minimum 1-year year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

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PART 2 PRODUCTS

2.1 FIRE ALARM SYSTEM

A. General Requirements:

1. Provide new fire alarm system complying with NFPA 70, NFPA 72, NFPA 90A, and consisting of required equipment, conduit, cabinets, outlet boxes, wiring, connectors, hardware, supports, accessories, components, software, and system programming as necessary for complete operating system that provides functional intent indicated.
2. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
    a. 36 CFR 1191 and ADA Standards.
    b. Requirements of AHJ.
    c. Applicable local codes.
    d. Contract Documents.
    e. NFPA 72; "should" is mandatory; where conflicts between requirements require deviation, identify deviations clearly on design documents.
3. Fire Alarm System Products:
    a. Listed, classified, and labeled as suitable for purpose intended.
    b. Installation Environments: Provide products suitable for their respective indoor and outdoor applications.
4. Fire Alarm System Design Information:
    a. Building Code: Comply with applicable building code.
        1) Principle Occupancy: As indicated on Architect code summary drawings.
        2) Principle Use: As indicated on Architect code summary drawings.
    b. NFPA 72 Fire Alarm System Classification: Protected premises.
    c. Smoke and Heat Detector Coverage: Partial or selective coverage in accordance with NFPA 72.
5. Provide fire alarm circuits in accordance with NFPA 70.
    a. Comply with methods of interconnecting FACUs in accordance with NFPA 72 and NFPA 70.
    b. Power Sources:

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1) Comply with requirements for power supplies of emergency systems in accordance with NFPA 70.

2) Primary: Dedicated branch circuits from facility power distribution system.

3) Secondary: Storage batteries with capacity to operate system for period specified by NFPA 72.

c. Wiring and Wiring Methods:

1) General Requirements:

(a) Comply with requirements for wiring and wiring methods in accordance with NFPA 70.

(b) Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum-rated, listed and labeled as suitable for use in return air plenums.

(c) Special Occupancies: Comply with NFPA 70.

(d) Comply with NFPA 70 for wire and cable plenum, riser, general-purpose, limited-use, undercarpet, and underground applications.

2) Fire Alarm Circuits:

(a) Comply with NFPA 70 for conditions and types required for multiconductor cable systems.

(b) Non-Power-Limited Fire Alarm (NPLFA) Circuits:

(1) Provide dedicated NPLFA non-GFCI branch circuits for fire alarm equipment and marked by red identification in accordance with NFPA 70.

(c) Power-Limited Fire Alarm (PLFA) Circuits:

(1) Provide identification for PLFA circuits in accordance with NFPA 70.

3) Fire-Rated Cables and Cable Systems:

(a) Performance alternative approved by AHJ.

(b) Provide cable fastening and listing requirements in accordance with NFPA 70. Provide indication of application, use cases, and product make and model for which listing applies.

(c) Provide additional classification suffix marking on cable system; observable by AHJ.

6. Provide pathway class designations and pathway survivability, as defined in NFPA 72.

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a. Provide monitoring of conductors and other signaling channels for integrity and circuit performance.

b. Pathway Class Designations:

1) Unless otherwise indicated or required, pathways to meet the following requirements:

(a) SLCs: Class B (star, tee-tap, multi-tap, with no return).

(b) IDCs: Class B (daisy-chain with EoL resistor device installed at end of circuit).

(c) NACs: Class B (daisy-chain with EoL resistor device installed at end of circuit).

c. Pathway Survivability:

1) Unless otherwise indicated or required, pathways to meet requirements for Pathway Survivability Level 0 (nonrated cable, no required provisions for pathway survivability).

7. Spare System Capacity:

a. SLCs: Minimum 25 percent spare capacity.

b. NACs: Minimum 25 percent spare capacity.

8. Secondary Power Source - Battery Storage Capacity:

a. Provide standby (nonalarm) operation sufficient for 24 hours.

b. Provide additional alarm operation for 15 minutes.

c. Calculate combined of standby load plus alarm load for overall battery storage capacity requirements, per power supply.

d. Provide 25 percent additional overall battery capacity correction factor.

e. Provide 25 percent spare battery capacity.

B. Fire Alarm System Interfaces and Control Functions:

1. UL 864 listed unless otherwise indicated.

2. Descriptions below are intended to provide means for interface. See project SOOs, narrative, and input/output matrix for execution requirements.

3. Provide initiating devices, interfaces, and control functions for emergency control function interfaces in accordance with NFPA 72.

4. Provide monitoring of interconnected systems. Coordinate notification appliance alternate markings as indicated on drawings.

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5. Lighting/Dimming Control Systems:
    a. System Override:
        1) Provide output signal to override lighting/dimming controls via addressable relay module and power isolation relay.
        2) Provide connection to UL 864 listed control system interface or interface with system control power where interruption of control power overrides system.
6. HVAC Systems:
    a. Air Handling Units (AHUs) and Roof Top Units (RTUs):
        1) Provide duct smoke detector on supply side of air stream for units indicated on drawings.
        2) Provide duct smoke detector on return side of air stream for units indicated on drawings.
        3) Provide remote test station for each duct smoke detector unless explicitly indicated as not required.
        4) Provide output signal to shut down units with at least one duct smoke detector via addressable relay module.
        5) Where fire/smoke dampers are located downstream of unit, provide monitoring point input to determine that unit is not operational and subsequently provide output signal to close such dampers via addressable relay module and power isolation relay.
    b. Remote Test Stations: Provide remote test station for each duct smoke detector unless explicitly indicated as not required. Unless otherwise indicated, use remote test stations only in clean, dry, indoor, nonhazardous locations.
7. Fire/Smoke Dampers:
    a. Provide output signal to close fire/smoke damper via addressable relay module and power isolation relay.
    b. Fire/smoke damper activated as indicated on drawings.

2.2 FIRE ALARM CONTROL UNITS AND RELATED EQUIPMENT

A. Manufacturers:
    1. Siemens Industry: www.siemens.com/#sle.
    2. No substitutions.
B. Fire Alarm Control Units and Related Equipment: Listed and labeled as complying with UL 864.

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C. Provide cabinets and enclosures as indicated or as required to house system components.

D. Fire Alarm Control Unit (FACU): Addressable.

1. SLCs and IDCs: Configurable for Class B or Class A with additional modules.
2. NACs: Integral and programmable with synchronization modules or cards as required.
3. Power Supply: 120 VAC, 60 Hz, supplying necessary power for FACU.
4. User-Interface: Touchscreen display for system interfacing and service mode settings, include password and user credentials; configurable for custom actions and incorporates historical event log.
5. Support self-testing detector capability.
6. Remote Annunciator Support: Up to 10.
7. Products:
    a. Siemens Industry; Desigo Compact Fire Alarm Panel: www.siemens.com/#sle.
    b. Siemens Industry; Desigo Modular Fire Alarm Panel: www.siemens.com/#sle.
    c. Substitutions: Not permitted.

E. Basis of Design - Addressable Fire Alarm Control Panel (FACP): Siemens Industry; Desigo Fire Safety; Model FC2025; www.siemens.com/#sle.

F. Notification Appliance Circuit Expansion:

1. Where notification appliance circuit requirements exceed capacity of FACU, provide accessories and cabinets as required for expansion.

G. Addressable Interface Modules:

1. General Requirements:
    a. Provide addressable modules suitable for connection to FACU SLCs.
    b. Unless otherwise indicated, use addressable modules only in clean, dry, indoor, nonhazardous locations.
2. Addressable Monitor Modules: Unless devices are explicitly permitted connected together on one zone; provide separate addressable monitor module for each conventional dry-contact input device in order to be individually identifiable by addressable FACU.
3. Addressable Control Modules: Provide as indicated or as required for selective control of notification appliances.
4. Addressable Relay Modules:

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a. Provide as indicated or as required to perform necessary functions via dry-contact interface.

b. Where load exceeds module contact rating, provide accessory power isolation relays suitable for load as required.

H. Alarm Communication:

1. Protected Premises Alarm and Signaling Systems:

a. Provide accessories as required for interface as indicated and as required by AHJ.

b. Provide accessories in accordance with building code, fire code, and life safety code requirements for occupancy classifications and use cases.

c. Include software and firmware control, required features, special requirements for low-power radio (wireless) systems, and fire alarm system interconnections required by NFPA 72.

I. Remote Annunciators:

1. Products:

a. Siemens Industry; Desigo Fire Safety; FT2015-U2.

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

2.3 FIRE ALARM SYSTEM INITIATING DEVICES

A. Manufacturers:

1. Siemens Industry: www.siemens.com/#sle.

2. Substitutions: Not permitted.

3. Source Limitations: Furnish initiating devices produced by same manufacturer as FACUs where possible.

B. General Requirements:

1. Addressable Systems:

a. Addressable Devices: Individually identifiable by addressable FACU; suitable for connection to FACU SLCs.

b. Conventional/Nonaddressable Devices: Provide addressable interface modules as indicated or as required for connection to addressable FACU. Unless devices are explicitly permitted to be connected together as one zone, provide separate addressable monitoring point for each device in order to be individually identifiable by addressable FACU.

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2. Provide devices and associated accessories suitable for intended application and location to be installed. Unless otherwise indicated, use addressable devices and addressable interface modules only in clean, dry, indoor, nonhazardous locations.
3. Surface-Mounted Devices: Provide manufacturer's accessory surface mount backboxes or suitable outlet/device box.
4. Devices for Outdoor and Damp/Wet Locations: Weatherproof, suitable for outdoor use; provide manufacturer's accessory backboxes or enclosures in accordance with product listing.
5. Devices for Hazardous/Classified Locations: Listed and labeled as suitable for classification of installed location.
6. Protective Covers for Fire Alarm Devices: See "Accessories" below.

C. Manual Fire Alarm Boxes/Pull Stations:

1. Description: Noncoded manual signaling boxes listed and labeled as complying with UL 38.
2. Alarm Initiation: Configured for general alarm initiation unless otherwise indicated; presignal stations (where indicated) require use of key to initiate general alarm.
3. Operation: Dual-action unless otherwise indicated or required.
    a. Dual-Action Operation: First requires pushing, pulling, or lifting, then pulling of lever.
4. Color: Red, in accordance with NFPA 72.
5. Station Reset: Requires use of key or tool.
6. Products:
    a. Siemens Industry; XMS-D Manual Pull Station: www.siemens.com/#sle.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

D. Spot-Type Detectors:

1. Utilize plug-in mounting to separate base with tamper-resistant feature; provide bases as indicated or as required.
2. Addressable Detectors:
    a. Provide LED indication of normal operation and regular communication with FACU and alarm condition.
3. Smoke Detectors:
    a. Listed and labeled as complying with UL 268.
    b. Provide sensor type (e.g., photoelectric, ionization) as indicated.

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4. Products:
    a. Siemens Industry; FDO421 Photoelectric Smoke Detector: www.siemens.com/#sle.
    b. Siemens Industry; FDOOT441 Multi-Criteria Fire Detector: www.siemens.com/#sle.
    c. Siemens Industry; FDOOTC441 Multi-Criteria Fire/CO Detector: www.siemens.com/#sle.
    d. Substitutions: See Section 01 60 00 - Product Requirements.

E. Duct Smoke Detectors:
1. Listed and labeled as complying with UL 268A.
2. Ratings: Compatible with air velocity, temperature, and humidity requirements for installed duct.
3. Housing: Select as required for application.
4. Sampling Tubes: Select as required for installation in duct to be monitored.
5. Products:
    a. Substitutions: See Section 01 60 00 - Product Requirements.

F. Accessories:
1. Remote Test Stations: Allows for detector key switch test and reset; provides visual and audible indication of alarm condition.
2. Remote Indicators: Provides visual and audible indication of alarm condition.
3. Provide Detector Bases As Indicated:
    a. Color: White, unless otherwise indicated.
4. Provide power supervision relays as required.

2.4 FIRE ALARM SYSTEM NOTIFICATION APPLIANCES

A. Manufacturers:
1. Siemens Industry: www.siemens.com/#sle.
2. No substitutions.
3. Source Limitations: Furnish notification appliances produced by same manufacturer as FACUs where possible.

B. General Requirements:

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1. Provide signaling notification appliances listed for fire-protective service and intended operating mode, public or private; suitable for connection to FACU notification appliance circuits.
2. Provide notification appliances and associated accessories suitable for intended application and location to be installed. Use notification appliances only according to listed mounting (e.g. ceiling, wall).
3. Surface-Mounted Notification Appliances: Provide manufacturer's accessory surface mount backboxes or suitable outlet/device box.
4. Exterior Notification:
    a. In addition to required occupant notification, provide notification appliances on exterior of building.
    b. Outdoor and Damp/Wet Locations: Weatherproof, suitable for outdoor use; provide manufacturer's accessory backboxes or enclosures in accordance with product listing.
    c. Visible Notification: Provide strobe beacon with red lens; interface to dedicated NAC or addressable control module, 24 VDC, supervised.
    d. Trouble Visible Notification: Provide strobe beacon with amber lens; interface to dedicated NAC or addressable control module, 24 VDC, supervised.
5. Notification Appliance Derating: Include device derating adjustments in accordance with listing where applicable, including the following.
    a. Where accessory protective guards or enclosures are utilized.
    b. Where required by field conditions (e.g., ambient temperature and sound).
6. Notification Appliance Color:
    a. Wall-Mounted: White.
    b. Ceiling-Mounted: White.
    c. See drawings for mounting configuration indicated by symbols on floor plans, system interconnection diagrams, and details.

C. Visible Notification Appliances:
1. Public Mode Operation: Listed and labeled as complying with UL 1971.
2. Strobes: Clear or nominal white lens with flash rate of 1 Hz unless otherwise indicated or required; LED light source with maximum pulse duration of 0.02 seconds; candela rating as indicated.
    a. Where field-selectable candela strobes are specified, substitution of fixed candela strobes is not permitted.

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D. Audible Notification Appliances:

1. Listed and labeled as complying with UL 464.
2. Rated Sound Pressure Level: As required to achieve design sound pressure levels, but not less than 75 dBA at 10 feet for public mode operation or 45 dBA at 10 feet for private mode operation in accordance with UL 464.
3. Horns: Selectable tone, including at minimum NFPA 72 temporal 3 pattern and continuous; minimum of two selectable volume levels.

E. Accessories:

1. Notification Appliance Bases: White, unless otherwise indicated.
2. Provide guards to protect notification appliances where subject to mechanical damage; listed for use with notification appliance.

F. Products:

1. Siemens Industry; SL2 Series Horn/Strobe: www.siemens.com/#sle.

2.5 WIRE AND CABLE

A. General Requirements:

1. Comply with NFPA 70 listing and marking requirements for cables.
2. Substitution of fire alarm listed cables for communication wiring, in accordance with NFPA 70, is not permitted.
3. Provide cables as indicated or as required for connections between system components.

2.6 ACCESSORIES

A. Provide components as indicated or as required for connection of fire alarm system to devices and other systems indicated.

B. Provide EoL resistors as required for wiring supervision.

C. Documentation Cabinets:

1. Provide cabinets, size as indicated or as required to comply with on-site documentation storage required by NFPA 72.
2. Cabinet: Steel; keyed to match fire alarm system equipment unless otherwise required by AHJ.

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PART 3 EXECUTION

3.1 EXAMINATION

A. Verify field measurements, including future system expansion as indicated on Contract Documents.

B. Verify that system capacities listed in manufacturer instructions align with designed system.

C. Verify that mounting surfaces are ready to accept components and equipment, with suitable support frames and anchors installed where required.

D. Verify ratings, configurations, and characteristics of system components.

E. Verify rough-ins for field connections.

F. Verify that work likely to damage fire alarm system has been completed.

G. Verify that interior of building has been protected from weather.

H. Perform preinstallation tests and inspections per manufacturer's instructions and in accordance with NECA 305.

I. Verify that system bonding is in accordance with Section 26 05 26.

J. Do not energize system until deficiencies have been corrected.

K. Verify that branch circuit wiring installation is completed, tested, and ready for connection to fire alarm system. Overcurrent protection ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

3.2 PREPARATION

A. Prior to installation, confirm environment of installation area is clean, and with ambient temperature, humidity, and ventilation requirements are per manufacturer’s written instructions.

1. Clean and vacuum in accordance with manufacturer's written instructions. Confirm equipment ventilation holes are absent of obstructions and free for air flow.

2. Clean pathways thoroughly to remove foreign materials before installing conductors and cables.

3. Clean dirt, debris, plaster, and other foreign materials from equipment enclosures, cabinets, and outlet boxes.

4. Clean surfaces to receive adhesive products according to manufacturer's instructions.

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B. Follow tool requirements for installation, including torquing adjustments, as listed in manufacturer documentation.

C. Remove detector dust covers prior to system energization.

3.3 INSTALLATION

A. Install field-devices, components, FACU and related equipment, and accessories in accordance with the following:

1. Manufacturer's instructions, applicable codes, and Contract Documents.
2. NECA 1.
3. NECA 305.
4. NFPA 72.
5. NFPA 70; including requirements for mechanical execution of work.

B. Field Locations:

1. Obtain CPL's approval of locations of devices and notification appliances before installation.
2. Arrange equipment to provide minimum operational clearances and required maintenance access in accordance with manufacturer's instructions and NFPA 70.
3. Conceal wiring, conduit, outlet boxes, and supports where installed in finished areas; maintain code-required access.

C. Raceways and Supports:

1. Coordinate locations of outlet boxes as required for installation. Only install boxes and equipment at locations based on application standards indicated in NFPA 72.
2. Secure and support raceways at intervals complying with NFPA 70. Provide supports where vertical rise exceeds permissible limits.
3. Provide minimum of six spare 1-inch trade size conduits out of each fire alarm panel stubbed into accessible space above ceiling.
4. Install firestopping to preserve fire resistance rating of partitions and other elements.
    a. Minimum height for pathways to pass through floor or wall, if cable fastening is required, and routing in elevator hoistways in accordance with NFPA 70.

D. Wiring and Connections:

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1. Maintain separation of Class 1, Class 2, Class 3 remote-control, signaling, fire alarm circuits, and power-limited circuits in accordance with cable insulation class and NFPA 70.
2. Maintain circuit pathway and class designations in accordance with NFPA 72 for configuration, separation, and survivability.
3. Comply with permitted and not permitted installations for wires, cables, cable routing assemblies, communications circuits, and fire alarm circuits in accordance with NFPA 70.
4. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by AHJ. Provide independent support from building structure and suspended ceiling systems. Do not provide support from raceways, piping, ductwork, or other systems.
5. Provide grounding and bonding in accordance with Section 26 05 26.
6. Comply with manufacturer's minimum cable sizes or ratings.
7. Do not exceed manufacturer's recommended maximum power, signal, or network cable lengths between components.
8. Provide network wiring in accordance with NFPA 70.
9. Neatly train and bundle conductors inside boxes, wireways, and cabinets.
10. Fire-Rated Cables and Cabling Systems: Comply with listing requirements to maintain installation, including aspects of attachment surfaces, specific products, and requirements associated with vertical and horizontal routing.
11. See manufacturer's instructions for batteries.

E. Fire Alarm System Components:

1. Install field-installed devices, components, relays, notification appliances, accessories, and when applicable EoL resistors.
    a. Install wiring to supervisory devices and associated EoL resistors as required for supervision of hardwired connections
2. Install Wall-Mounted Equipment: Assemble component hardware within (e.g., card bays, sub-bays, expansion bays, signal cards, other card frames, networking, signal transmission, application modules, tamper monitoring devices, interconnecting modules, and auxiliary power supplies), including space for required spare capacity, and configure settings.
3. Install Interconnect Wiring: Connect system cabinets, install processor and cards, cabling, connectors, terminations, and bonding.

F. Branch Power:

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1. After installation confirmations, follow manufacturer instructions to connect branch circuit power cables to premises fire alarm system components; comply with NFPA 70.
2. Where accessories require auxiliary power, provide control power source and monitoring as indicated or as required to complete installation.
3. Install auxiliary power supplies, including indicated monitoring, and connections necessary for remote equipment.

G. System Identification:

1. Identify devices, notification appliances, components, cables, and equipment in accordance with approved submittals. See Section 26 05 53.
2. Confirm fire alarm system programming meets requirements of SOO and sub-system SOOs.
3. Mark location of disconnecting means for NPFLA circuits.
4. Coordinate to provide red branch power circuit protective devices or identify them accordingly as required by NFPA 72 and NFPA 70.
5. Mark date of batteries installed on inside cover of panels and formal maintenance logs.

H. Troubleshooting and Installer Checks:

1. Field test connectivity periodically during installation process to avoid unexpected troubleshooting.
2. Check system operation for notification, FACU functions, circuit supervision, alarm initiating devices, supervisory initiating devices, dress panels/doors/covers, and programming before performing field tests.

I. Fire Alarm System Tests:

1. Perform required tests of NFPA 72. Record measured values during operational checks.
2. Confirm functional testing of fire alarm system is as indicated in Contract Documents.

3.4 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Provide services of manufacturer's authorized representation to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's detailed testing procedures and field reports and with submittals.

C. Provide equipment, two-way radios for testing personnel use, tools, and supplies required to accomplish inspection and testing.

D. Notify CPL and Engineer at least two weeks prior to scheduled inspections and tests.

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E. Inspect and test in accordance with manufacturer's instructions.

F. Inspect wiring and components for damage and defects.

G. Batteries and Power Supplies: Perform inspections and tests listed in manufacturer installation instructions.

H. Perform additional requirements related to testing and inspection during system startup.

I. Test for interface with other systems.

J. Test shunt trips to verify operation.

K. Correct defective work, adjust for operation, and retest until entire system complies with Contract Documents.

L. Submit detailed reports indicated inspection and testing results, corrective actions taken, and as-found and final adjusted settings.

3.5 SYSTEM STARTUP

A. Obtain CPL approval prior to performing system startup.

B. Manufacturer Services: Provide services of manufacturer's authorized representation to systems startup. Include manufacturer's detailed startup procedures with submittals.

C. Prepare and start equipment and systems in accordance with manufacturer's instructions and recommendations.

3.6 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust initiating device and notification appliance settings to achieve desired operation as indicated in submittals.

C. Measure power supply primary and secondary voltages, log values for records, and make appropriate adjustments.

D. Adjust alignment of equipment covers and doors. Provide keys and spare keys to CPL.

E. Reprint and reinstall damaged or misinstalled labels; maintain neat and square to installed location good workmanship - see NECA 1; maintain consistent placements for identification on products of similar type.

F. Adjust devices or notification appliances and associated bases to be flush and level.

G. Program system parameters according to requirements of CPL.

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3.7 CLEANING

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

B. See Section 01 74 19 - Construction Waste Management and Disposal for field-generated construction waste requirements.

C. Check tightness of electrical connections. Replace damaged components and provide closure plates for vacant positions. Provide circuit directory updates for related power branch circuits.

D. Clean and repair existing materials and equipment that remain or are indicated for reuse.

E. Clean dirt, debris, plaster, and other foreign materials from outlet boxes and fire alarm system equipment and components.

F. Clean fire alarm system equipment and components according to manufacturer's instructions and NECA 305.

G. Clean surfaces and interiors of boxes and device cover plates in accordance with manufacturer's instructions to remove dirt, fingerprints, debris, plaster, and other foreign materials.

H. Repair scratched or marred exposed surfaces to match original factory finish.

I. Comply with federal (EPA), state, and local regulations for battery handling and disposal. Do not spill battery fluids down plumbing drains. Only use containers safe for transportation marked 'nonspillable.'

3.8 COMMISSIONING

A. See Section 01 91 13 - General Commissioning Requirements for additional requirements.

B. Comply with NFPA 3 for commissioning of fire protection and life safety systems.

C. Comply with NECA 90 for commissioning building electrical systems.

D. Support Commissioning Agent in assembling test data and generating reports.

E. Participate in four hours of seasonal testing, as scheduled by Commissioning Agent, six months from Date of Substantial Completion.

3.9 INSPECTION AND TESTING FOR COMPLETION

A. Notify CPL 7 days prior to beginning completion inspections and tests.

B. Notify AHJ and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

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C. Provide services of installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D. Prepare for testing by ensuring that work is complete and correct; perform preliminary tests as required.

E. Provide tools, software, and supplies required to accomplish inspection, testing, and document results.

F. Perform inspection and testing in accordance with NFPA 72 and requirements of AHJ; document each inspection and test.

G. Correct defective work, adjust for operation, and retest until entire system complies with Contract Documents.

H. Diagnostic Period: After successful completion of inspections and tests, operate system in normal mode for at least 14 days without system or equipment malfunctions.

1. Record system operations and malfunctions.
2. If malfunction occurs, start diagnostic period over after correction of malfunction.
3. CPL will provide attendant operator personnel during diagnostic period; schedule training to allow CPL personnel to perform normal duties.
4. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

3.10 CPL PERSONNEL INSTRUCTION

A. Provide the following instruction to designated CPL personnel:

1. Hands-On Instruction: On-site, using operational system.
2. Classroom Instruction: CPL furnished classroom, on-site or at other local facility.

B. Administrative: One-hour session(s) covering issues necessary for nontechnical administrative staff; classroom:

1. Initial Training: One session precloseout.

C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:

1. Initial Training: One session precloseout.

D. Use operation and maintenance documentation as primary instruction material; have paper copies available for attendees and supplement training material aids.

E. Provide means of evaluation of trainees suitable to type of training given; report results to CPL.

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3.11 CLOSEOUT ACTIVITIES

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

B. See Section 01 79 00 - Demonstration and Training for additional requirements.

C. Closeout Demonstration: Demonstrate operation of all functions to CPL.

1. Be prepared to conduct any of required tests.
2. Have minimum one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
3. Have authorized technical representative of FACU manufacturer present during demonstration.
4. Demonstration may be combined with inspection and testing required by AHJ; notify AHJ with enough time to schedule demonstration.
5. Repeat demonstration until successful.

D. Occupancy will not occur prior to Substantial Completion.

E. Substantial Completion of project cannot be achieved until inspection and testing is successful and the following:

1. Specified diagnostic period without malfunction has been completed.
2. Approved operating and maintenance data has been delivered.
3. All aspects of operation have been demonstrated to CPL.
4. Final acceptance of fire alarm system has been given by AHJ.
5. Occupancy permit has been granted.
6. Specified precloseout instruction is complete.

F. Perform post-occupancy instruction within three months after Substantial Completion.

3.12 PROTECTION

A. Protect installed fire alarm system from subsequent construction operations.

3.13 MAINTENANCE

A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements relating to maintenance service.

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B. Provide to CPL, at no extra cost, written maintenance contract for entire manufacturer's warranty period, to include work described below.

C. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:

1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.

2. Repairs required, unless due to improper use, accidents, or negligence beyond control of maintenance contractor.

3. Record keeping required by NFPA 72 and AHJ.

D. Provide trouble call-back service upon notification by CPL:

1. Provide on-site response within two hours of notification.

2. Include allowance for call-back service during normal working hours at no extra cost to CPL.

3. CPL will pay for call-back service outside of normal working hours on hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

E. Provide complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with detailed schedule.

F. Maintain on-site log listing date and time of each inspection and call-back visit, condition of system, nature of trouble, correction performed, and parts replaced. Submit duplicate of each log entry to CPL's representative upon completion of site visit.

G. Comply with CPL's requirements for access to facility and security.

END OF SECTION 28 46 00

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SECTION 31 00 00 - SITE CLEARING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Clearing and Grubbing
2. Stripping and stockpiling topsoil
3. Removal of trees and stumps as indicated on the drawings
4. Removing and disposing of all vegetation and debris within the limits of the project and easement areas
5. Removing above- and below-grade site improvements.

1.3 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches in diameter; and free of weeds, roots, toxic materials, or other non-soil materials.

D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated in the Plans.

F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

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1.5 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
   1. Use sufficiently detailed photographs or video recordings.
   2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.

B. Topsoil stripping and stockpiling program.

C. Rock stockpiling program.

D. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

E. Burning: Burning will not be allowed on the site.

1.6 QUALITY ASSURANCE

A. Topsoil Stripping and Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

B. Mark all trees designated to remain and obtain concurrence by the Owner prior to removing any trees.

1.7 FIELD CONDITIONS

A. Existing facilities, structures, and utilities are shown in accordance with available field survey data and record drawings. The indicated locations of trees, underground utilities and structures are approximate. Other trees and utilities may exist which are not indicated.

B. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

C. Utility Locator Service: Notify Ohio Utilities Protection Service (O.U.P.S.) for area where Project is located before site clearing.

D. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

E. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 PRODUCTS

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2.1 MATERIALS

A. Paint required for cut or scarred surfaces of trees or shrubs selected for retention shall be a suitable asphaltum base paint.

B. Herbicide: Comply with Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) – 7 U.S.C. §136 et seq. Submit copy of herbicide label, bearing EPA registration number.

PART 3 EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Protect trees and vegetation to remain using fences, barricades, wrapping, or other methods specified or accepted by the CMT. Tree protection shall be outside the trees' drip line. Do not cut or injure trees and vegetation outside easement lines and outside designated clearing areas.

C. Protect all existing underground utilities, structures and site improvements to remain from damage during construction.

1. Contractor shall restore damaged improvements to their original condition, as acceptable to Owner.
2. If a utility line is damages, the Contractor shall immediately notify the utility owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

3.3 EXISTING UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed.

1. Arrange with utility companies to shut off indicated utilities.
2. Owner will arrange to shut off indicated utilities when requested by Contractor.

C. Locate, identify, and disconnect utilities indicated to be abandoned in place.

D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

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1. Notify the Owner and the Engineer not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner's written permission.

E. Excavate for and remove underground utilities indicated to be removed.

3.4 CLEARNING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Grind down stumps and remove roots larger than 3 inches in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
3. Use only hand methods or air spade for grubbing within protection zones.
4. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material as per the Geotechnical Investigation Report, unless further excavation or earthwork is indicated.

3.5 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
1. Limit height of topsoil stockpiles to 72 inches.
2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.6 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw- cut faces vertically.

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2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Burning tree, shrub, and other vegetation waste will not be allowed.

C. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 31 00 00

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SECTION 31 20 10 – SURVEY LAYOUT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 CONSTRUCTION SURVEYING

A. The Contractor shall perform all necessary construction surveying and layout staking.

3.2 AS-BUILT SURVEYS

A. The Contractor shall perform an as-built topographic survey of reasonable accuracy and identify any variation from the Contract Documents.

END OF SECTION 31 20 10

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SECTION 31 22 00 – EARTH MOVING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

B. *Geotechnical Engineering Services Report*, prepared by Intertek PSI, dated December 15, 2025, is available for viewing as appended to the Project Manual; see Appendix Item # 01 and Section 00 31 32 GEOTECHNICAL DATA.

1.2 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the site.
2. Excavating and backfilling trenches for utilities and pits for buried utility structures.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil brought from another location on the site for use as fill or backfill.

E. Borrow Area: As shown on plans.

F. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

G. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.

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3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

H. Fill: Soil materials used to raise existing grades.

1. General Fill: Fill soil obtained from either Stratum 1 or Stratum 2 (defined below).
2. Engineered Fill: Fill soil obtained from Stratum 2 (defined below).

I. Import: approved soil material brought to the site from another location for use as fill or backfill.

J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

K. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

L. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

M. Topsoil: Defined as upper six inches of soil material measured down from existing grade elevation.

N. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Geotextiles.
2. Offsite fill material (import).

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: The Contractor shall hire a qualified Geotechnical Testing Agency to perform soil classifications, establish soil compaction curves, optimum moisture content, and maximum dry density.

B. Material Test Reports: For each on-site and import soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D2487.
2. Laboratory compaction curve according to ASTM D698 (Standard Proctor).

1.6 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E329 and ASTM D3740 for testing indicated.

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1.7 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify Ohio Utility Protection Service (O.U.P.S.) for area where Project is located before beginning earth-moving operations.

C. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 015723 "Temporary Storm Water Pollution Control" are in place.

D. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

E. Do not direct vehicle or equipment exhaust towards protection zones

F. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

A. As per the Geotechnical Investigation Report or 31 22 00 Earth Moving.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: as per the Geotechnical Investigation Report recommendations.

B. Separation Geotextile: as per the Geotechnical Investigation Report recommendations.

C. Submit product information on Subsurface Drainage and Separation Geotextiles to Engineer and Owner for review and approval.

PART 3 EXECUTION

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3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

3.3 EXPLOSIVES

A. The use of explosives will not be permitted.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and other materials not classified as rock or unauthorized excavation.

    a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

B. Excavation at Edges of Tree- and Plant-Protection Zones

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1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.6 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: As indicated in the Plan details.

C. Trench Bottoms: Excavate and shape trench bottoms as per the General Details shown in the Plans.

3.7 SUBGRADE INSPECTION

A. Notify Owner when excavations have reached required subgrade.

B. If the Geotechnical Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade as per the recommendations of the Geotechnical Investigation Report.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions per Section 31 20 40 “Unforeseen Conditions” and Section 31 20 70 “Unsuitable Soils.”

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.8 STORAGE OF MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.9 BACKFILL

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A. Place and compact backfill in excavations promptly, but not before completing the following:
   1. Construction below finish grade including,where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
   2. Surveying locations of underground utilities for Record Documents.
   3. Testing and inspecting underground utilities.
   4. Removing concrete formwork.
   5. Removing trash and debris.
   6. Removing temporary shoring, bracing, and sheeting.
   7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
   8. Place backfill on subgrades free of mud, frost, snow, or ice.

3.10 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Public Roadways: Follow requirements of the authority having jurisdiction of the roadway, or, provide 4-inch-thick concrete encasement for piping or conduit less than 30 inches below surface of roadways. After installing and testing of piping or conduit, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 32 13 13 – “Concrete Paving, Curbs, Walks, and Headwalls”.

D. Backfill voids with satisfactory soil while removing shoring and bracing.

E. Initial Backfill:

   1. Soil Backfill: Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.

      a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Final Backfill:

   1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

3.11 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows.

   1. Under grass and planted areas, use satisfactory soil material.
   2. Under walks and pavements, use satisfactory soil material.

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C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.12 SOIL MOISTURE CONTROL

A. Control subgrade and fill or backfill moisture content as recommended in the Geotechnical Investigation Report.

3.13 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Follow the recommendations of the Geotechnical Investigation Report for the compaction of soil backfills and fills.

3.14 GRADING

A. For site grading, follow the recommendations of the Geotechnical Investigation Report.

3.15 SUBSURFACE DRAINAGE

A. Subsurface Drain: Follow the recommendations of the Geotechnical Investigation Report.

B. Drainage Backfill: Follow the recommendations of the Geotechnical Investigation Report

3.16 BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place base course under pavements and walks as follows:

1. Place base course material over subbase course under hot-mix asphalt pavement.
2. Shape base course to required crown elevations and cross-slope grades.
3. Place base course 6 inches or less in compacted thickness in a single layer.
4. Place base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
5. Compact base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D698 (Standard Proctor).

3.17 FIELD QUALITY CONTROL

A. Refer to the Geotechnical Investigation Report for quality control recommendations for earthwork items.

3.18 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

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B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and re-compact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 22 00

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SECTION 31 23 00 – EXCAVATION AND FILL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

B. *Geotechnical Engineering Services Report, prepared by Intertek PSI, dated December 15, 2025*, is available for viewing as appended to the Project Manual; see Appendix Item # 01 and Section 00 31 32 GEOTECHNICAL DATA.

C. ODOT CMS – Item 203 Excavation and Embankment

1.2 SUMMARY

A. Section Includes:

1. This work shall consist of preparation of areas upon which fill is to be placed; excavation for roadways and structures, including the removal of all material encountered not being removed under some other item; constructing fill areas with the suitable material and material from other sources necessary to complete the planned work; furnishing and incorporating all water required for compacting fills and subgrade; disposing of unsuitable and surplus material; preparing the subgrade; testing the stability and uniformity of compaction of the subgrade and fill for areas; finishing shoulders, slopes and ditches; all in accordance with these specifications and in reasonably close conformity with the lines, grade, thicknesses and cross sections shown on the plans.
2. Fill
3. Excavation
4. Subgrade Preparation

B. Section Excludes

1. Backfill requirements for underground utilities
2. Tunnel and shaft excavation

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM International) Publications:

1. C33: Standard Specification for Concrete Aggregates
2. C618: Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
3. D698: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort

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4. D1556: Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
5. D2167: Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
6. D2487: Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
7. D4832: Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders
8. D6938: Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

B. Occupational Safety and Health Administration (OSHA) Standards and Regulations:

1. 29 CFR 1926, Subpart P: Safety and Health Regulations for Construction

1.4 DEFINITIONS

A. Embankment: A structure consisting of suitable material constructed in layers to a predetermined elevation and cross section.

B. Subbase: Selected material of planned thickness placed on the subgrade as a foundation for a base or surface course.

C. Soil: All earth materials, organic or inorganic, which have resulted from natural processes such as weathering, decay, and chemical action in which more than 35 percent by weight of the grains or particles will pass a No. 200 sieve.

D. Granular Materials: Natural or synthetic mineral aggregate such as broken or crushed rock, gravel, or sand which can be readily incorporated in an 8-inch layer, and in which at least 65 percent by weight of the grains or particles are retained on a No. 200 sieve. No slag material is permitted.

E. Shale: Laminated material, formed by the consolidation in nature of soil, having a finely stratified structure. For the purpose of these specifications, the following bedrock types shall also be considered as shale: mudstone, claystone, siltstone and clay bedrock.

F. Rock: Sandstone, limestone, dolomite, and glacial boulders which cannot readily be incorporated in an 8-inch fill layer.

G. Random Material: A mixture of previously defined materials suitable for use in embankment which can be readily incorporated in an 8-inch fill layer.

H. Optimum Moisture: The water content at which the maximum density is produced in a soil as determined by ASTM D698, or field test strip.

I. Field Testing: Contractor shall conduct testing of fill and subgrade compaction and provide results to the Owner.

J. Laboratory Dry Weight: The maximum laboratory dry weight shall be the weight provided by the Laboratory when the sample is tested in accordance with ASTM D698.

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K. Excavation: The excavation and disposal of all materials of whatever character encountered in the work.

L. Borrow: Material obtained from accepted sources, outside the project limits, and used for the construction of fills or for other portions of the work.

M. Geotextiles: Synthetic fabrics and used for subgrade reinforcement (geogrids), erosion and sedimentation control, or drainage filters.

1.5 SUBMITTALS

A. If applicable, copy of properly completed and accepted Notice of Intent to Fill permit, as submitted to the local approved agency of the Ohio Environmental Protection Agency.

B. Temporary excavation and shoring drawings for worker protection in accordance with Section 31 50 00 Excavation Support Systems.

C. Materials Sources: Name of source, location, date of sample, sieve analysis, and laboratory compaction characteristics.

D. Site Plans: Indicating the location, excavation dimensions, site grading, and site development details for the excavation and all work areas, and the proposed limits of disturbance surrounding each excavation.

E. Disposal Locations: Name and location of final destination for all materials hauled off site.

F. Test and Evaluation Reports:

1. Field density testing reports: Provide results from field density testing of prepared subgrade and compacted fill.
2. Grain-size analysis for placed fill materials.
3. Laboratory compaction characteristics of soils.
4. Water content.

1.6 TOLERANCES

A. Provide Owner with adequate survey information to verify compliance with the lines and grades specified.

1.7 QUALITY REQUIREMENTS

A. Provide quality control testing and inspection to assure that all materials and placed fill conform to the requirements of this Section.

1.8 PERMITS

A. If applicable, Contractor shall file a “Notice of Intent to Fill” with the local approved agency of the Ohio Environmental Protection Agency for any material that is to be removed from the site and used as fill at a different site.

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PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Suitable Material:

1. As specified in ODOT CMS Item 203 or other requirements of the Contract Documents geotextiles

B. Unsuitable Material:

1. As specified in ODOT CMS Item 203 or other requirements of the Contract Documents.
2. Organic clay, organic silt, or peat; as defined in ASTM D2487.
3. Vegetation, wood, roots, leaves, and organic, degradable material.
4. Stones or rock fragments over 6 inches in any dimension.
5. Porous biodegradable matter, excavated pavement, construction debris, rubbish, or refuse.
6. Ice, snow, frost, or frozen soil particles.
7. Silt (ML), Unified Soil Classification System (USCS) in accordance with ASTM D2487
8. Slag.
9. Contaminated material

C. Structural Fill

1. Well graded granular material having a uniformity coefficient greater than 4 for gravels and 6 for sands, and a coefficient of gradation between 1 and 3 (for gravels and sands), free from organic matter.
2. Not more than 50 percent by weight shall pass through a No. 40 sieve; 5 to 12 percent by weight shall pass through a No. 200 sieve; and 100 percent shall pass a 2-inch square sieve.

D. Aggregate Base Course – As specified in ODOT CMS, or other requirements of the Contract Documents.

1. Aggregate acceptance shall be determined prior to incorporation into the work.
2. Prior to placing, aggregate shall have a reasonably uniform moisture content at or near optimum for compaction.

E. Utility Trench Backfill Under Pavements

1. As indicated in the City of Cleveland Standard Drawings

F. Controlled Low-Strength Mortar (LSM)

1. This work shall consist of the placement of a flowable material consisting of portland cement, fly ash and/or sand with an expected 28-day unconfined compressive strength less than 100 pounds per square inch.
2. Fine aggregate shall be natural sand or sand manufactured from stone, or gravel. The sand shall be fine enough to stay in suspension in the mixture to ensure proper flow.
3. The low strength mortar mixture may consist of the following quantities of materials per cubic yard as specified in Table 31 23 00-1.

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4. These mixtures of materials are expected to yield approximately one cubic yard of material of a flowable consistency. Small adjustments in the amounts of the materials in a mix may be required to achieve the final project. No additional compensation for a change in the material blends shall be allowed.
5. Fly ash to be per ASTM C 618, Class C or F, except the maximum loss on ignition shall be three (3) percent.

Table 31 23 00-1

	Type 1 * lbs./yd.^{3}	Type 2 lbs./yd.^{3}	Type 3 lbs./yd.^{3}
Cement	50	100	0
Fly Ash, Class F	250	**	1500
Fly Ash, Class C ****	0	0	297
Sand ***	2910	2420	0
Water (Target)	500	210 - 300	850

*An Air entraining agent specifically designed for the use in the LSM mixture may be added to this mix.

**Entrained air is substituted for fly ash in this mix.

***Saturated Surface Dry

****Class C Fly Ash may be substituted for Class F Fly Ash in Type 1 mixes with an accepted mix design criteria of this specification.

PART 3 EXECUTION

A. Execution shall be in accordance with ODOT CMS Item 203, or other requirements of the Contract Documents.

END OF SECTION 31 23 00

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SECTION 31 63 29 - DRILLED CONCRETE PIERS AND SHAFTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Dry-installed drilled piers.

1.3 UNIT PRICES

A. Drilled Piers: Actual net volume of drilled piers in place and approved. Actual length, shaft diameter, and bell diameter if applicable, may vary, to coincide with elevations where satisfactory bearing strata are encountered. These dimensions may also vary with actual bearing value of bearing strata determined by an independent testing and inspecting agency. Adjustments are made on net variation of total quantities, based on design dimensions for shafts and bells.

1. Base bids on indicated number of drilled piers and, for each pier, the design length from top elevation to bottom of shaft, extended through the bell, if applicable, and the diameter of shaft and bell.
2. Unit prices include labor, materials, tools, equipment, and incidentals required for excavation, trimming, shoring, casings, dewatering, reinforcement, concrete fill, testing and inspecting, and other items for complete drilled-pier installation.

B. Trial Drilled Pier: Same unit price as indicated for drilled pier, including backfilling.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to drilled piers including, but not limited to, the following:

a. Review geotechnical report.
b. Discuss existing utilities and subsurface conditions.
c. Review coordination with temporary controls and protections.
d. Review measurement and payment of unit prices.

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1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture. Submit alternative design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Shop Drawings: For concrete reinforcement, detailing fabricating, bending, supporting, and placing.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer professional engineer and testing agency.

B. Welding certificates.

C. Material Certificates: From manufacturer, for the following:

1. Cementitious materials.
2. Admixtures.
3. Steel reinforcement and accessories.

D. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Record drawings.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in drilled-pier work.

B. Testing Agency Qualifications: Qualified according to ASTM C1077, ASTM D3740, and ASTM E329 for testing indicated.

C. Special Inspector Qualifications: A qualified person employed or retained by an approved agency that has the recommended experience and certifications as summarized in Appendix C of the current International Code Council (ICC) Special Inspection Manual.

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."

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1.9 TRIAL DRILLED PIER

A. Trial Drilled Pier: Construct trial drilled pier of diameter and depth and at location indicated or, if not indicated, of same diameter and depth as largest drilled piers, located at least three diameters clear of permanent drilled piers, to demonstrate Installer's construction methods, equipment, standards of workmanship, and tolerances.

1. Install reinforcement, fill with concrete, remove temporary casings, and terminate trial drilled pier 24 inches below subgrade and leave in place.
2. If Architect determines that trial drilled pier does not comply with requirements, excavate for and cast another until it is accepted.

1.10 FIELD CONDITIONS

A. Existing Utilities: Locate existing underground utilities before excavating drilled piers. If utilities are to remain in place, provide protection from damage during drilled-pier operations.

1. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, adapt drilling procedure if necessary to prevent damage to utilities. Cooperate with Owner and utility companies in keeping services and facilities in operation without interruption. Repair damaged utilities to satisfaction of utility owner.

B. Interruption of Existing Utilities: Do not interrupt any utility to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:

1. Notify Architect and Owner no fewer than [two] days in advance of proposed interruption of utility.
2. Do not proceed with interruption of utility without Architect's or Owner's written permission.

C. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from this data.

1. Make additional test boring and conduct other exploratory operations necessary for drilled piers.
2. The geotechnical report is included elsewhere in the Project Manual.

D. Survey Work: Engage a qualified land surveyor or professional engineer to perform surveys, layouts, and measurements for drilled piers. Before excavating, lay out each drilled pier to lines and levels required. Record actual measurements of each drilled pier's location, shaft diameter, bottom and top elevations, deviations from specified tolerances, and other specified data.

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1. Record and maintain information pertinent to each drilled pier and indicate on record Drawings. Cooperate with Owner's testing and inspecting agency to provide data for required reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Drilled-Pier Standard: Comply with ACI 336.1 except as modified in this Section.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A706/A706M, deformed.

C. Joint Dowel Bars: ASTM A615/A615M, Grade 60, plain. Cut bars true to length with ends square and free of burrs.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C150/C150M, Type I/II

2. Retain supplementary cementing materials from "Fly Ash" and "Ground Granulated Blast-Furnace Slage" subparagraphs below if permitted. Ready-mix concrete manufacturer blends these materials with portland cement. Fly ash, slag, or pozzolanic materials may slow rate of concrete strengthening. Availability of Class F fly ash predominates over Class C fly ash.

a. Fly Ash: ASTM C618, Class C Class F.
b. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.

B. Normal-Weight Aggregate: ASTM C33/C33M, graded, 3/4-inch > nominal maximum coarse-aggregate size. Provide aggregate from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C94/C94M and potable.

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D. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
3. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
4. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

E. Sand-Cement Grout: Portland cement, ASTM C150/C150M, Type II; clean natural sand, ASTM C404; and water to result in grout with a minimum 28-day compressive strength of 1000 psi, of consistency required for application.

2.4 STEEL CASINGS

A. Steel Pipe Casings: ASTM A283/A283M, Grade C, or ASTM A36/A36M, carbon-steel plate, with joints full-penetration welded according to AWS D1.1/D1.1M.

B. Corrugated-Steel Pipe Casings: ASTM A929/A929M, steel sheet, zinc coated.

C. Liners: Comply with ACI 336.1.

2.5 SLURRY

A. Slurry: Pulverized bentonite pulverized attapulgite or polymers mixed with water to form stable colloidal suspension; complying with ACI 336.1 for density, viscosity, sand content, and pH.

2.6 CONCRETE MIXTURES

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 limits as if concrete were exposed to deicing chemicals.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Proportion normal-weight concrete mixture as follows:

1. Compressive Strength (28 Days): 4000 psi

2. Retain water-cementitious materials ratio from three options in "Maximum Water-Cementitious Materials Ratio" Subparagraph below or revise to suit Project; delete if in-service durability conditions are benign and limits on water-cementitious materials ratio

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are not required. Coordinate water-cementitious materials ratio with compressive strength.

3. Maximum Water-Cementitious Materials Ratio: 0.45.
4. Minimum Slump: Capable of maintaining the following slump until completion of placement:

    a. 4 inches for dry, uncased-cased drilling method.
    b. 6 inches for temporary-casing drilling method.
    c. 7 inches for slurry displacement method.

5. Air Content: Do not air entrain concrete.

2.7 REINFORCEMENT FABRICATION

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, vibration, and other hazards created by drilled-pier operations.

3.2 EXCAVATION

A. Unclassified Excavation: Excavate to bearing elevations regardless of character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions.

1. Obstructions: Unclassified excavation may include removal of unanticipated boulders, concrete, masonry, or other subsurface obstructions. No changes in the Contract Sum or the Contract Time are authorized for removal of obstructions.
2. Obstructions: Unclassified excavated materials may include removal of unanticipated boulders, concrete, masonry, or other subsurface obstructions. Payment for removing obstructions that cannot be removed by conventional augers fitted with soil or rock

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teeth, drilling buckets, or underreaming tools attached to drilling equipment of size, power, torque, and downthrust necessary for the Work is according to Contract provisions for changes in the Work.

B. Classified Excavation: Excavation is classified as standard excavation, special excavation, and obstruction removal and includes excavation to bearing elevations as follows:
   1. Special excavation includes excavation that requires special equipment or procedures where drilled-pier excavation equipment used in standard excavation, operating at maximum power, torque, and downthrust, cannot advance the shaft.
      a. Special excavation requires use of special rock augers, core barrels, air tools, blasting, or other methods of hand excavation.
      b. Earth seams, rock fragments, and voids included in rock excavation area are considered rock for full volume of shaft from initial contact with rock.
   2. Obstructions: Payment for removing unanticipated boulders, concrete, masonry, or other subsurface obstructions that cannot be removed by conventional augers fitted with soil or rock teeth, drilling buckets, or underreaming tools attached to drilling equipment of size, power, torque, and downthrust necessary for the Work is according to Contract provisions for changes in the Work.

C. Prevent surface water from entering excavated shafts. Conduct water to site drainage facilities.

D. Excavate shafts for drilled piers to indicated elevations. Remove loose material from bottom of excavation.
   1. Excavate bottom of drilled piers to level plane within 1:12 tolerance.
   2. Remove water from excavated shafts before concreting.

E. Notify and allow testing and inspecting agency to test and inspect bottom of excavation. If unsuitable bearing stratum is encountered, make adjustments to drilled piers as determined by Architect.
   1. Do not excavate shafts deeper than elevations indicated unless approved by Architect.
   2. Payment for additional authorized excavation is according to Contract provisions for changes in the Work.

F. End-Bearing Drilled Piers: Probe with auger to a depth of 96 inches below bottom elevation of shaft, and visually inspect and classify soil. Verify continuity and thickness of strata.
   1. Test first three drilled piers and one of every six drilled piers thereafter.

G. Excavate shafts for closely spaced drilled piers and for drilled piers occurring in fragile or sand strata only after adjacent drilled piers are filled with concrete and allowed to set.

H. Slurry Displacement Method: Stabilize excavation with slurry maintained a minimum of 60 inches above ground-water level and above unstable soil strata to prevent caving or sloughing of shaft. Maintain slurry properties before concreting.

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1. Excavate and complete concreting of drilled pier on same day, or redrill, clean, and test slurry in excavation before concreting.

I. Temporary Casings: Install watertight steel casings of sufficient length and thickness to prevent water seepage into shaft; to withstand compressive, displacement, and withdrawal stresses; and to maintain stability of shaft walls.

1. Remove temporary casings, maintained in plumb position, during concrete placement and before initial set of concrete, or leave temporary casings in place.

J. Tolerances: Construct drilled piers to remain within ACI 336.1 tolerances.

1. If location or out-of-plumb tolerances are exceeded, provide corrective construction. Submit corrective construction proposals to Architect for review before proceeding.

3.3 STEEL REINFORCEMENT INSTALLATION

A. Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy bond with concrete.

C. Fabricate and install reinforcing cages symmetrically about axis of shafts in a single unit.

D. Accurately position, support, and secure reinforcement against displacement during concreting. Maintain minimum cover over reinforcement.

E. Use templates to set anchor bolts, leveling plates, and other accessories furnished in work of other Sections. Provide blocking and holding devices to maintain required position during final concrete placement.

F. Protect exposed ends of extended reinforcement, dowels, or anchor bolts from mechanical damage and exposure to weather.

3.4 CONCRETE PLACEMENT

A. Place concrete in continuous operation and without segregation immediately after inspection and approval of shaft by a qualified Special Inspector.

1. Construct a construction joint if concrete placement is delayed more than one hour. Level top surface of concrete and insert joint dowel bars. Before placing remainder of concrete, clean surface laitance, roughen, and slush concrete with commercial bonding agent or with sand-cement grout mixed at ratio of 1:1.

B. Dry Method: Place concrete to fall vertically down the center of drilled pier without striking sides of shaft or steel reinforcement.

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1. Where concrete cannot be directed down shaft without striking reinforcement, place concrete with chutes, tremies, or pumps.
2. Vibrate top 60 inches of concrete.

C. Slurry Displacement Method: Place concrete in slurry-filled shafts by tremie methods or pumping. Control placement operations to ensure that tremie or pump pipe is embedded no less than 60 inches into concrete and that flow of concrete is continuous from bottom to top of drilled pier.

D. Coordinate withdrawal of temporary casings with concrete placement to maintain at least a 60-inch head of concrete above bottom of casing.

1. Vibrate top 60 inches of concrete after withdrawal of temporary casing.

E. Screed concrete at cutoff elevation level and apply scoured, rough finish. Where cutoff elevation is above the ground elevation, form top section above grade and extend shaft to required elevation.

F. Protect concrete work, according to ACI 301, from frost, freezing, or low temperatures that could cause physical damage or reduced strength.

1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
2. Do not use calcium chloride, salt, or other mineral-containing antifreeze agents or chemical accelerators.

G. If hot-weather conditions exist that would seriously impair quality and strength of concrete, place concrete according to ACI 301 to maintain delivered temperature of concrete at no more than 90 deg F.

1. Place concrete immediately on delivery. Keep exposed concrete surfaces and formed shaft extensions moist by fog sprays, wet burlap, or other effective means for a minimum of seven days.

3.5 FIELD QUALITY CONTROL

A. Special Inspections and field quality control testing: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

1. Refer to drawings for testing and special inspection requirements.

2. Prepare and submit inspection reports within 7 days of completing tests and inspections. Distribute reports to Architect, Engineer, Owner (or owner's representative), and Contractor. Clearly indicate non-compliance on reports. Prepare inspection reports for each drilled concrete pier.

B. Non-Compliant Work:

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1. The contractor shall remove and replace all non-compliant work, or, at the contractor's expense, perform additional testing to verify compliance. Contractor shall submit results of additional testing to Architect, Engineer, and Owner (or owner's representative) for review and approval.

3.6 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

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SECTION 32 12 16 – ASPHALT PAVING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

B. Ohio Department of Transportation (ODOT) Construction and Materials Specifications (CMS).

1.2 SUMMARY

A. Section Includes:

1. Asphalt Paving
2. Aggregate Base
3. Subgrade Compaction

1.3 ACTION SUBMITTALS

A. Product Data: Include technical data and tested physical and performance properties.

B. Hot Mix Asphalt mix design proposed for the work.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality control reports.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not me.

1. Tack Coat: Minimum surface temperature of 60 degrees F.
2. Asphalt Base Course: Minimum surface temperature of 60 degrees F and rising at the time of placement.
3. Asphalt Surface Course: Minimum surface temperature of 60 degrees at time of placement.

PART 2 PRODUCTS

A. Materials - As per ODOT CMS or elsewhere in the Contract Documents.

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PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protection: Provide protective materials, procedures, and worker training to prevent asphalt materials from spilling, coating, or building up on curbs, driveway aprons, manholes, and other surfaces adjacent to the Work.

B. Proof-roll as per ODOT CMS.

C. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by on-site Geotechnical Engineer, and replace with compacted suitable backfill.

3.3 SURFACE PREPARATION

A. Ensure that prepared subgrade has been proof-rolled and is ready to receive paving. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces.

B. Tack Coat: Apply uniformly to surfaces of existing pavement at the rate specified by the Plan Details.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.4 SUBGRADE INSPECTION

A. Subgrade inspection and proof rolling shall be in accordance with ODOT CMS or as recommended by the Geotechnical Investigation Report.

3.5 BASE COURSE UNDER PAVEMENT

A. Aggregate base shall be placed as per ODOT CMS.

3.6 HOT MIX ASPHALT PLACEMENT

A. Driveway/parking lot pavement buildup shall be as shown in the drawings. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
2. Place hot-mix asphalt surface course in single lift.
3. Spread mix at a minimum temperature of 250 deg F.

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4. Begin applying mix along centerline of crown for crowned sections and on high side of one- way slopes unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
2. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.7 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method in accordance with AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.8 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot- mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

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1. Average Density, Marshall Test Method: 96 percent of reference laboratory density in accordance with ASTM D6927 or AASHTO T 245, but not less than 94 percent or greater than 100 percent.
2. Average Density, Rice Test Method: 92 percent of reference maximum theoretical density in accordance with ASTM D2041/D2041M, but not less than 90 percent or greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.9 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch.
2. Surface Course: Plus 1/4 inch, no minus

B. Pavement Surface Smoothness: Compact each course to produce surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas.

1. Base Course: 1/4 inch.
2. Surface Course: 1/8 inch.
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: At the Owner’s discretion, the Owner may engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined in accordance with ASTM D3549/D3549M.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

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D. Asphalt Traffic-Calming Devices: Finished height of traffic-calming devices above pavement will be measured for compliance with tolerances.

E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement in accordance with ASTM D979/D979M or AASHTO T 168.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared in accordance with ASTM D2041/D2041M, and compacted in accordance with job-mix specifications.
2. Field density of in-place compacted pavement will be determined by nuclear method in accordance with ASTM D2950/D2950M and coordinated with ASTM D1188 or ASTM D2726/D2726M.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.11 WASTE HANDLING

A. General: Contractor shall remove all asphalt paving waste from the site.

END OF SECTION 32 12 16

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SECTION 32 13 13 – CONCRETE PAVING, CURBS AND WALKS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

B. Ohio Department of Transportation (ODOT) Construction and Materials Specifications (CMS).

1.2 SUMMARY

A. Section Includes:

1. Standard duty concrete pavement
2. Heavy duty concrete pavement.
3. Aggregate base.
4. Subgrade preparation.
5. Curbs.
6. Walks.
7. Headwalls.

1.3 ACTION SUBMITTALS

A. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality control reports.

1.5 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.

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3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

PART 2 PRODUCTS

2.1 CONCRETE, GENERAL

A. As per ODOT CMS, ACI 301 or elsewhere in the Contract Documents.

2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

A. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, fabricated from steel wire into flat sheets.

B. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.

C. Epoxy-Coated Welded-Wire Reinforcement: ASTM A884/A884M, Class A, plain steel.

D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

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2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

E. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.

2.4 CONCRETE MATERIALS

A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project.

1. Portland Cement: ASTM C150/C150M, gray Portland cement Type I/II.
2. Fly Ash: ASTM C618, Class C or Class F.

B. Normal-Weight Aggregates: ASTM C33/C33M, uniformly graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Air-Entraining Admixture: ASTM C260/C260M.

D. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

E. Color Pigment: ASTM C979/C979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.

1. Color: As selected by Architect from manufacturer's full range.

F. Water: Potable and complying with ASTM C94/C94M.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry or cotton mats.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating.

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F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 2, Class B, dissipating.

2.6 RELATED MATERIALS

A. Joint Fillers: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork in preformed strips.

2.7 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301 for each type and strength of normal- weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash or Pozzolan: 25 percent.
2. Slag Cement: 50 percent.
3. Combined Fly Ash or Pozzolan, and Slag Cement: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: 6 percent plus or minus 1-1/2 percent for 1-inch nominal maximum aggregate size.
2. Air Content: 6 percent plus or minus 1-1/2 percent for 3/4-inch nominal maximum aggregate size.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture plasticizing and retarding admixture in concrete as required for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

G. Concrete Mixtures: Normal-weight concrete.

1. Compressive Strength (28 Days): 4000 psi.
2. Maximum W/C Ratio at Point of Placement: 0.50.

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3. Slump Limit: 4 inches, plus or minus 1 inch.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete batches larger than 1 cu. yd, increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction Limit vehicle speed to 3 mph.
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to the Geotechnical Investigation Report.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 SUBGRADE INSPECTION

A. Subgrade inspection and proof rolling shall be as specified in ODOT 204.

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3.4 BASE COURSE UNDER CONCRETE PAVEMENT OR WALK

A. Aggregate base shall be placed as specified in ODOT 304 and per the Plan Details.

3.5 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.6 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

D. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D3963/D3963M.

3.7 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
2. Provide tie bars at sides of paving strips where indicated.
3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 50 feet unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.

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3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows, to match jointing of existing adjacent concrete paving:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes.

3.8 CONCRETE PAVEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating joint devices.

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H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

3.9 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.10 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

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1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

F. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.

G. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.11 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 3/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-feet- long; unleveled straightedge not to exceed 1/2 inch.
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch.
6. Vertical Alignment of Dowels: 1/4 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: At the Owner’s discretion, the Owner may engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

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2. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C231/C231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C31/C31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C39/C39M; test one specimen at seven days and two specimens at 28 days.
    a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive- strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sono-scope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.13 REPAIR AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Engineer/Architect.

B. Drill test cores, where directed by Engineer/Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

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C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 13

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SECTION 32 14 13 - PRECAST CONCRETE UNIT PAVING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interlocking permeable concrete paver units.

B. Sand joint filler.

C. Aggregate fill.

D. Edge restraints.

1.2 RELATED REQUIREMENTS

A. Section 31 22 00 - Earth Moving: Preparation of subsoil for pavers.

B. Section 31 23 00 - Excavation and Fill: Compacted fill for pavers.

1.3 REFERENCE STANDARDS

A. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2024a.

B. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2026.

C. ASTM C936/C936M - Standard Specification for Solid Concrete Interlocking Paving Units; 2024.

D. ASTM C1645 - Standard Test Method for Freeze-thaw and De-icing Salt Durability of Solid Concrete Interlocking Paving Units; 22a.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide characteristics of paver units, and edging.

C. Samples: Submit two samples of each paver type, illustrating style, size, color range and surface texture of units being provided.

D. Maintenance Materials: Provide the following for Owner's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.

2. Extra Pavers: 10 of each type and size.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Interlocking Permeable Concrete Pavers:

1. Unilock; Eco-Priora Classic River: www.unilock.com.

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2.2 MATERIALS

A. Interlocking Concrete Pavers: Hydraulically pressed concrete, configured for interlocking with adjacent units and complying with ASTM C936/C936M.

1. Compressive Strength: 8000 pounds per square inch average, with minimum of 7200 pounds per square inch, when tested in accordance with ASTM C140/C140M.
2. Absorption: Less than 5 percent.
3. Freeze-Thaw Resistance: Maximum of 225g/m^2 weight loss, demonstrated by laboratory testing in a 3% saline solution, in accordance with ASTM C1645.
4. Size: 5"X10" nominal (4-3/4 by 9-1/2 inch, actual).
5. Thickness: 3-1/8 inches (80mm).
6. Type: Rectangular.
7. Color: "River".

B. Free Draining Base: Open-graded aggregate, complying with requirements of ASTM C33/C33M for No. 57 crushed stone.

C. Clear Chip Setting Bed: Clean washed crushed stone complying with gradation requirements of ASTM C33/C33M for No. 9 stone.

D. Sand for Joints: Fine washed sand with 100 percent passing No. 16 sieve and not more than 10 percent passing No. 200 sieve.

E. Edging for Permeable Pavers: Permaloc Corporation; GeoEdge: www.permaloc.com.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate is level or to correct gradient, smooth, capable of supporting pavers and imposed loads, and ready to receive work of this Section.

B. Verify gradients and elevations of substrate are correct.

3.2 PREPARATION

A. Treat soil with herbicide to retard plant growth.

B. See Section 31 22 00 for subsoil preparation.

C. See Section 31 23 00 for fill compaction requirements.

3.3 INSTALLATION OF SOLID PAVER UNITS

A. Spread sand bedding evenly over prepared substrate surface to a maximum thickness of 1-1/2 inch.

B. Dampen and roller compact sand to level and even surface.

C. Screed and scarify top 1 inch to 1 1/2 inch of sand.

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D. Place paver units in perpendicular running bond pattern creating staggered joints, from straight reference edge.

E. Cut paver units at edges with masonry saw.

F. Place edging at edge and interruptions. Maintain tight joints.

G. Sprinkle sand over surface and sweep into joints. Moisten joints and recover with additional sand until firm joints are achieved. Remove excess sand.

H. Tamp and level paver units with mechanical vibrator until units are firmly bedded, level, and to correct elevation and gradients. Do not tamp unrestrained edges.

3.4 CLEANING

A. Clean soiled surfaces using cleaning solution. Do not harm pavers, joint materials, or adjacent surfaces.

B. Use non-metallic tools in cleaning operations.

C. Rinse surfaces with clean water.

D. Broom clean paving surfaces. Dispose of excess sand.

3.5 PROTECTION

A. Do not permit traffic over unprotected paver surface.

B. Protect paver surface with sheets of plywood.

END OF SECTION

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SECTION 32 31 19 - DECORATIVE METAL FENCES AND GATES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Decorative steel fences and gates.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete.

1.3 REFERENCE STANDARDS

A. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2025.

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

C. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2026.

D. ASTM D523 - Standard Test Method for Specular Gloss; 2025.

E. ASTM D714 - Standard Test Method for Evaluating Degree of Blistering of Paints; 2025.

F. ASTM D822/D822M - Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings; 2013 (Reapproved 2018).

G. ASTM D1654 - Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments; 2024.

H. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates; 2025.

I. ASTM D2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact); 1993 (Reapproved 2024).

J. ASTM D3359 - Standard Test Methods for Rating Adhesion by Tape Test; 2023.

K. ASTM F1267 - Standard Specification for Metal, Expanded, Steel; 2018 (Reapproved 2023).

L. ASTM F2408 - Standard Specification for Ornamental Fences Employing Galvanized Steel Tubular Pickets; 2016 (Reapproved 2023).

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. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings:

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1. Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.

D. Samples: For illustrating construction and colored finish.

1. Samples: Submit samples of assembled fence panels made from full-size components, including posts, rails, pickets, and expanded metal mesh, 16 inch by 24 inch in size illustrating construction and colored finish.

a. Sample need not be full height.

b. For gates, show method of welding and finishing members at intersections.

2. Fittings and brackets.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Experienced with type of construction involved and materials and techniques specified and approved by fence manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

A. Store materials in a manner to ensure proper ventilation and drainage. Protect against damage, weather, vandalism and theft.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Decorative Steel Fences and Gates:

1. (Basis of Design) Ameristar Perimeter Security, an Assa Abloy Group company; Aegis II Industrial Ornamental Steel Fence, Majestic style: www.ameristarperimeter.com.

2. Ametco Manufacturing Corporation: www.ametco.com.

3. A&T Iron Works, Inc: www.atironworks.com.

4. BarnettBates Corporation: barnettbates.com.

5. Betafence a PRÆSIDIAD brand: www.praesidiad.com/betafence.

6. Builders Fence Company (BFC): www.buildersfence.com.

7. Fortress Fence Products: www.FortressFence.com.

8. Iron Eagle Industries: ironeagleind.com.

9. Iron World Manufacturing, LLC: ironworldfencing.com.

10. XCEL Fence Inc: www.xcelfence.com.

2.2 FENCES - GENERAL

A. Fences: Complete factory-fabricated system of posts and panels, accessories, fittings, and fasteners; finished with electrodeposition coating, and having the following performance characteristics:

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B. Electro-Deposition Coating: Multistage pretreatment/wash with zinc phosphate, followed by epoxy primer and acrylic topcoat.
   1. Total Coating Thickness: 2 mils, minimum.
   2. Coating Performance: Comply with general requirements of ASTM F2408.
      a. Adhesion: ASTM D3359 (Method B); Class 3B with 90 percent or more of coating remaining in tested area.
      b. Corrosion Resistance: ASTM B117, ASTM D714 and ASTM D1654; 1/8 inch coating loss or medium No.8 blisters after 1,500 hours.
      c. Impact Resistance: ASTM D2794; 60 inch pounds.
      d. Weathering Resistance: ASTM D523, ASTM D822/D822M and ASTM D2244; less than 60 percent loss of gloss after 1,000 hours.

C. Steel: ASTM A653/A653M; tensile strength 45,000 psi, minimum.
   1. Hot-dip galvanized; ASTM A653/A653M, G60.
   2. 62 percent recycled steel, minimum.

D. Expanded Metal Mesh: ASTM F1267 Type II (expanded and flattened); steel, hot-dip galvanized.

E. Fasteners: ASTM A276/A276M, Type 302 stainless steel; finished to match fence components.
   1. Tamper-proof security bolts.

2.3 STEEL FENCES AND GATES

A. Provide fence meeting requirements for Industrial class as defined by ASTM F2408.

B. Fence Panels: Fusion welded or mechanically fastened with internal reinforcement and tamperproof fasteners; 6 feet high by 8 feet long.
   1. Panel Style: Number of rails, top and bottom treatment, as indicated on drawings.
   2. Attach panels to posts with manufacturer's standard panel brackets.

C. Posts: Steel tube, with manufacturer's standard cap.
   1. Fence Panel Posts - Size: 2-1/2 inches square by 14 gauge, 0.079 inch, minimum.
   2. Gate Posts - Size: 4 inches square by 11 gauge, 0.120 inch, minimum.

D. Rails: Manufacturer's standard, double-wall steel channel 1-3/4 inch square by 14 gauge, 0.0785 inch with prepunched picket holes.
   1. Picket Retaining Rods: 0.125 inch galvanized steel.
   2. Picket-to-Rail Intersection Seals: PVC grommets.

E. Fence Panel Infill: Steel pickets.
   1. Spacing: 3-3/4 inch clear.
   2. Size: 1 inch square by 16 gauge, 0.059 inch.
   3. Style: As indicated on drawings.

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F. Gate Panels: Pickets with expanded metal mesh welded to inside of gate frame and pickets; fusion weld frames, pickets, and mesh; finished to match adjacent fence panels.

1. Basis of Design: Ameristar; 1" Pickets with X-Span 0.75" X #9

G. Fence Panel Flexibility: Capable of following variable slope of up to 1:2 30 inches over 8 feet.

H. Color: Bronze.

2.4 SPECIALTY HARDWARE

A. Hinges: Finished to match fence components.

1. Closing: Manual.
2. Material: Steel.
3. Mounting: Weld on.
4. Bearings: Plain.

B. Mounting Plates: Steel, finished to match fence components.

C. Exit Device:

1. Specified in Section 08 71 00.

2.5 ACCESSORIES

A. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; steel.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Set fence posts in accordance with the manufacturer recommended spacing.

C. When cutting rails immediately seal the exposed surfaces by:

1. Removing metal shavings from cut area.
2. Apply zinc-rich primer to thoroughly cover cut edge and drilled hole; allow to dry.
3. Apply two coats of custom finish spray paint matching fence color.
4. Failure to seal exposed surfaces in accordance with manufacturer's instructions will negate manufacturer's warranty.

D. Space gate posts according to the manufacturers' drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware specified.

1. Base type and quantity of gate hinges on the application, weight, height, and number of gate cycles.
2. Identify the necessary hardware required for the application on the shop drawings.

E. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter indicated.

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F. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
3. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth.

G. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.2 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch.

B. Maximum Offset From Indicated Position: 1 inch.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Gates: Inspect for level, plumb, and alignment.

C. Workmanship: Verify neat installation free of defects.

3.4 CLEANING

A. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.

B. Clean fence with mild household detergent and clean water rinse well.

C. Remove mortar from exposed posts and other fencing material using a 10 percent solution of muriatic acid followed immediately by several rinses with clean water.

D. Touch up scratched surfaces using materials recommended by manufacturer. Match touched-up paint color to factory-applied finish.

3.5 PROTECTION

A. Protect installed products until completion of project.

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

END OF SECTION

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SECTION 32 33 00 - SITE FURNISHINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Benches.

1.2 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Anchors to attach site furnishings to mounting surfaces.

1.3 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's specifications and descriptive literature, installation instructions, and maintenance information.

C. Shop Drawings: Indicate plans for each unit or group of units, elevations with model number, overall dimensions, construction, and anchorage details.

D. Samples: Submit two sets of manufacturer's available colors and finishes for precast furnishings.

PART 2 PRODUCTS

2.1 PRECAST CONCRETE FURNISHINGS

A. Precast Concrete Furnishings, General:

1. Precast Concrete Components: Mixture of cement, aggregates, water, and mineral colors; molded to shape, and reinforced with steel bars.
    a. Finish:
        1) Horizontal Surfaces: Smooth for seats and table tops.
        2) Vertical Surfaces: Smooth for supports and sides.
    b. Color: As selected by Architect from manufacturer's standard range.
    c. Clear Sealers: Anti-graffiti.
2. Hardware: Stainless steel.

B. Precast Concrete Seat Walls:

1. Locations: Where indicated in drawings.
2. Mounting: Freestanding.
3. Basis of Design:
    a. Landscape Forms Inc; Serp Bench. In the following configurations:
        1) Type A1: Serp Straight.

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2) Type A2: Serp R1915.

3) Type A3: Serp r1185.

4) Type A4: Serp R185

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

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify proper installation of mounting surfaces, preinstalled anchor bolts, and other mounting devices; and ready to receive site furnishing items.

B. See Section 05 50 00 for anchors to attach site furnishings to mounting surfaces.

C. Do not begin installation until unacceptable conditions are corrected.

3.2 INSTALLATION

A. Install site furnishings in accordance with approved shop drawings, and manufacturer's installation instructions.

B. Provide level mounting surfaces for site furnishing items.

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SECTION 32 91 00 – PLANTING SOIL SYSTEM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

All the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this Section and are hereby made a part of this Section.

1.2 SUMMARY

The scope of work of this Section consists of all site preparation work and related items as indicated on the Drawings and/or as specified herein and includes, but are not limited to the following:

A. Evaluation of rough subgrade water infiltration.
B. Planting soil material acquisition.
C. Testing and analysis for specification conformance.
D. Inspection and testing of subgrade for preparation of subgrade.
E. Preparation of mixes and testing for conformance.
F. Installation and placement of soils.
G. Installation and placement of landscape underdrainage piping
H. Decompaction of soils.
I. Mock-up of planting soil profiles.
J. Final in-place testing of soils.
K. Coordination with other trades.
L. Clean-up.

M. Other materials including, but not limited to, geotextile, geogrid, aggregate, subbase material, backfill, root barrier, Water + Air System, and planting soil.

Related work under other sections. Carefully examine all the Contract Documents for the requirements that affect the work of this Section. Other specification Sections that directly relate to the work of this Section include, but are not limited to, the following:

N. Section 32 92 10, "Turf and Grasses."
O. Section 32 93 10, "Exterior Planting."

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1.3 QUALITY ASSURANCES / DEFINITIONS

Definitions:

A. Compaction: Compaction of the soil fabric is any force applied to the soil that reduces porosity and where 90 percent of all compactions can be accomplished with only three applications of force under optimum soil moisture conditions.
B. Dry Soil: The condition of the soil at or below the wilting point of plant available water in which the soil is powdery and subject to blowing.
C. Frozen Soil: The point at which the soil water has frozen, and the soil has become very hard and cloddy. Ice crystals can be seen in the pore spaces of the soil.
D. Field Capacity: The percentage of water remaining in a soil two or three days after having been saturated and after free gravimetric drainage has ceased.
E. Moist Soil: The condition of the soil in where it can be formed into a ball and maintain its shape. Deformation of the soil is difficult with hand pressure. Free water is not visible and is usually considered the point between the wilting point and field capacity of the soil.
F. Saturated: All the pore space within a soil is filled with water and the remaining water is under gravitational forces to drain through the profile.
G. Scarification: The loosening of the surface of a soil lift by mechanical or manual means to alleviate compaction of the soil surface. Depth of scarification is dependent on material and extent of compaction. Depths are noted within the specifications.
H. Subsoil: The soil horizon directly below topsoil that provides water holding and structural support to plants. Source of the majority of micro-nutrients.
I. Subgrade: The in-situ soil material that the planting soil will be installed upon.
J. Topsoil: The mineral surface layer of soil that exhibit obliteration of all or much of the original rock structure and must show the following: (1) an accumulation of humified organic matter closely mixed with the mineral fraction and not dominated by properties characteristic of subsurface horizons; (2) has reasonable tilth (biological, chemical and physical properties) to support plant growth; and have two or more of the following: a bulk density of less than 1.5g/cc installed less than 15 percent by weight coarse fragments greater than 2mm identifiable structure between clods called peds, no massive structure no contamination (ie. Toxic weeds, chemicals, heavy metals, construction debris)
K. Wet Soils: Soils that are considered wet will easily be deformed by hand pressure, maintain their shape, and free water will be visible within the pore spaces. The water content at this soil condition is considered at field capacity or wetter.

Analysis and Testing of Materials: For each type of packaged material required for the work of this Section, provide manufacturer's certified analysis. For all other materials, provide complete analysis by a recognized laboratory made in strict compliance with the standards and procedures of the following:

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L. American Society of Testing Materials (ASTM)
M. American Society of Agronomy
N. Soil Science Society of America
O. Association of Official Agricultural Chemists.

Quality Assurance: Work and materials shall meet the standards of the following references:

P. International Society of Arboriculture
Q. American Society for Testing Materials (ASTM)
R. Environmental Protection Agency (EPA)

Installer Qualifications: A qualified landscape installer whose work has resulting in successful establishment of exterior plants.

S. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site who has at least 5 years experience with projects of similar scale and complexity.
T. The Landscape Contractor shall have experience in the proper and safe transportation and installation of soil material.
U. The Landscape Contractor shall have adequate supervision, staff, equipment and experience needed to complete a project of this magnitude.
V. The Landscape Contractor shall prepare and present to the Landscape Architect required soil submittals, and their associated specified test results six months prior to the scheduled soil and plant installation.
W. The Landscape Contractor shall have at between 3 to 5 years experience in installing designed soil mixes.

Soil Mixing Contractor Qualifications:

X. Shall be able to provide soil mixes that meet the specifications within tolerances assigned.
Y. Shall be able to produce enough consistently uniform soil material for the project to meet the scheduled demands.
Z. The soil mixing contractor shall be engaged at least six months prior to scheduled soil installation to allow for sufficient time for material searches and initial planting mix approval.

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Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

AA. Work with library arborist to do qualified independent testing and inspection laboratory acceptable to the Landscape Architect and Owner to perform tests and certifications indicated.

BB. It is the responsibility of Landscape Contractor in conjunction with the Soil Supplier to submit material for the soil and compost tests.

CC. Tests shall be made in strict compliance with the standards of the Association of Official Analytical Chemists and follow standards from ASTM, EPA, and/or Methods of Soil Analysis, Soil Science Society of America.

DD. Approved Laboratories include the following or approved equal. Other equivalent laboratories can be substituted, but require approval by the Landscape Architect:

a. Agricultural Analytical Services Laboratory

Penn State University

Tower Road

University Park, PA 16802

Tel: 814-863-0841

Fax: 814-863-4540

Email: aaslab@psu.edu

b. Rutgers Soil Testing Laboratory

Rutgers, The State University of New Jersey

57 US Highway 1

New Brunswick, NJ 08901-8554

Phone: 848-932-9295

Email: soiltest@njaes.rutgers.edu

NOTE: RUTGERS DOES NOT HAVE BIOSOLID TESTING

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c. McNitt & SerenSoil Testing, LLC

1338 Deerfield Drive,

State College, PA 16803

Ph: 61-.360.5985

tom@turfsoiltesting.com

andy@turfsoiltesting.com

http://www.turfsoiltesting.com/

1.4 SUBMITTALS AND TESTING

Certificates: Provide certificates required by authorities having jurisdiction, including any composted materials containing biosolids. Approval as EPA Type 1 “exceptional quality” is required as well as standards for application of composted organic material by the State of New Jersey.

A. Compost Test for Indicator Pathogens: Pass rating: per US EPA Class A standard, 40 CFR § 503.32(a)

Testing Intervals for Organic Amendments, Planting Soil Mixes and Subgrade: Testing is required at the following intervals:

B. Testing of the organic compost material: Test certificates required for producers of municipal yard waste composts or composted biosolids are described within this Section 329100 Part 1.5 and shall follow criteria listed within Part 2 of this section.
C. Submit complete test results and samples of the S3, S2, and organic soil amendment (compost) materials for approval as described within Part 1.5 and follow criteria of Part 2 of this section.
D. After test results for the composted organic material have been accepted the Contractor shall create sample soil mixes for the S1 and Bio-filtration Topsoil soil layers for the planting soil mix and perform the complete tests described in Section 329100, Part 1.5.

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E. In-place planting soil testing shall follow methods specified in Part 1.5 c 3 of this section for the layers and intervals noted following the specific ranges and limits noted within Part 2 of this section.

F. During the placement of planting soils, test every 1000 cubic yards (or one test for every planting area) of planting soil mix delivered to the job site. Tests shall be for soil mix quality assurance to maintain adherence to particle size distribution, pH, organic matter, salts, and Ammonium. Report organic matter content on a percent by weight basis. Testing applies to all soil layers of the Soil Profile (S1, S2, S3, and Bio-filtration Topsoil). Testing procedures are described in Part 1.5 of this section.

Test Procedures and Reporting: Submit certified report for each test required

G. Compost: Analyses of composted organic materials, including composted biosolids, are required prior to initial soil mix acceptance. Analyses shall include all tests specified below and meet the criteria listed in Part 2 of this section.

    a. Maturity index either by Solvita, Dewar Self Heating or CO2 evolution sometimes called respirometry.
    b. Reaction in 1:1 water
    c. Carbon/Nitrogen ratio
    d. Foreign Material on a dry weight basis
    e. Organic Mater percent on a dry weight basis
    f. Ammonium-N using an extract method
    g. Salinity using a 1:1 water paste method
    h. Basic Nutrient content of macro nutrients (P, K, Ca, Mg)
    i. If the compost material contains any biosolids, heavy metals must be tested to meet EPA Chapter 503 and comply with the New Jersey Bureau of Pretreatment and Residuals for use in soils.

H. Soil Mixes and Topsoil: Testing shall be performed and reported for particle size requiring percent of gravel (>2.0 mm), very coarse sand (2.0 – 1.0 mm), coarse sand (1.0 – 0.5 mm), medium sand (0.5 – 0.25 mm), fine sand (0.25 – 0.10 mm), very fine sand (0.10 – 0.05 mm), silt (0.05 – 0.002 mm) and clay (< 0.002 mm). Saturated conductivity, bulk density, pH, total porosity, salt content, Ammonium content and organic matter percentage on a dry weight basis shall also be tested.

    a. Particle size distribution by ASTM F1632-03 for all soil layers and topsoil. Fines passing the #270 sieve are to be measured using the hydrometer method as outlined in ASTM F1632. If any alternate method is used such as ASTM D422, the results still must be reported at the specified particle size breaks listed below or by plotting as a particle size distribution curve on a five cycle semi-log graph.

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b. Organic matter content by ASTM F 1647-02a, commonly known as loss on ignition.
c. Salts and Ammonium test using Woods End Research Laboratory # 104 Soluble Ion Test or 1:2 soil/water extract test as specified in Methods of Soil Analysis, Part 3 and must be tested and made available to the Landscape Architect or Soil Scientist within two weeks of planned soil installation.
d. Plant available Phosphorous, Potassium and Cation Exchange Capacity tested for the S1 Planting Soil Mix and S1b Bio-filtration Topsoil ONLY.

I. In-place designed soil testing:

a. General planting soil installation shall be tested using a cone penetrometer or equivalent for one point every 100 ft^2 at an interval for S2 layer installation and complete soil profile installation.
b. In-place Density Tests for soils prescribed under sidewalks and pervious parking surfaces shall be conducted for at least three tests of surface soil density per segment as noted on the drawings. The surface that is to support pavement construction is to be tested. Density testing shall conform to ASTM standards using either ASTM D1556 or ASTM D6938-07b and shall be at 90% of Standard Proctor measured at below optimum moisture content (Do not compact planting soils at moisture contents above the “Optimum” line).
c. Bio-filtration in-place testing. Saturated hydraulic conductivity of the Bio-filtration basins as per New Jersey Stormwater Guidance Manual. Additional investigation on compaction and conductivity will be based on observed installed soil geomorphological parameters for all Bio-filtration Basins.

Sources for Soil Components and Planting Soil Mixes: Submit information identifying sources for all soil components and the contractor responsible for mixing of planting soil mixes.

J. Owner or Landscape Architect shall have the right to reject any soil supplier.
K. Soil mix supplier shall have a minimum of five years experience at supplying custom planting soil mixes.
L. Submit supplier name, address, telephone, and fax numbers and contact name.
M. Submit certification that accepted supplier can provide sufficient quantities of materials and mixes for the entire project. Indicate quantity and type of material from each supplier.

Samples: Planting soils require a long lead time. Prior to ordering the listed materials, submit representative samples of the same organic batches and soil mixes that will be used to the Landscape Architect for selection and approval. Schedule at least 4 months for soil ingredient search and initial

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submittal approval. Delivered materials shall closely match the approved samples. For each sample, provide date obtained, label material, identify address of origin location and manufacturer's contact information.

N. Organic amendment: duplicate samples of 1 quart.
O. Soil Mix: duplicate samples of 1 quart for each soil layer after mixing organic material and soil. The Soil Mix shall match the material being placed as closely as possible.

1.5 DELIVERY, STORAGE AND HANDLING

Store and handle packaged materials in strict compliance with manufacturer's instructions and recommendations. Protect all materials from weather, damage, injury and theft.

Sequence deliveries to avoid delay. On-site storage space is permissible only with written notice from Owner. Deliver soil materials only after preparations for placement of planting soil have been completed.

Prohibit vehicular and pedestrian traffic on or around stockpiled planting soil.

Soil that is to be stockpiled longer than two weeks, whether on or off site, shall not be placed in mounds greater than six feet high. If soil stockpiles greater than six feet high are to be stored for more than two weeks, the contractor shall break down and disperse soil so that mounds do not exceed the six-foot height restriction or thoroughly mix the stockpile once a month.

Vehicular access to the site is restricted. Prior to construction the Contractor shall submit for approval a plan showing proposed routing for deliveries and site access which shall include, but not limited to equipment movements and staging locations.

Soil materials shall be covered at least two weeks prior to installation to prevent excess moisture from saturating the soil stockpile. Test for the moisture content of the soil mix using the gravimetric oven dry method as described in Soil Science Society of America, Methods of Soil Analysis, Part 1, 1986 at least two days prior to soil installation.

Soil materials shall not be handled or hauled, placed or compacted when it is wet, as after precipitation, nor when frozen. Soil shall be handled only when the moisture content is less than 8 percent by volume.

The planting soil shall be mixed in a ball mill or tub mill fitted with proper screening and paddles. Windrowing the materials is not acceptable, as it does not produce uniform mixing of the components.

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1.6 ACCEPTANCE AND MAINTENANCE

Soil Installation Acceptance: Notify the landscape architect at least 10 days in advance of date of soil placement. Inspection of the soil installation shall take place during placement of the S3 layer while some of the subgrade is visible and another inspection during the placement of the S2 layer before placement of the S1 layer. Final inspection shall take place during S1 installation.

Partial Acceptance: Acceptance of partial areas or portions of the total work may be granted at the option of the Landscape Architect only if the area to be inspected for acceptance is large, well defined and easily described. The Landscape Architect is not obligated to provide partial acceptance of the work.

Final Acceptance: Final acceptance shall be defined as the date after which the Landscape Architect and Soil Scientist determine that all work, including Punch List items has been satisfactorily completed.

PART 2 PRODUCTS

2.1 SOIL LAYERS (HORIZONS):

General

A. Soil amendments in specifications are not final, coordination based on onsite soil conditions need to be coordinated to finalized amendments.
B. All plant mix material shall fulfill the requirements as specified and be tested to confirm the specified characteristics.
C. Samples of individual components of plant mixes in addition to blended plant mixes including mulch materials shall be submitted by the Contractor for testing and analysis to the approved testing laboratory. Include verification testing of on-site sub soils. Comply with specific materials requirements specified.

    a. No base component material or soil components for plant soil mixes shall be used until certified test reports by an approved agricultural chemist have been received and approved by the Landscape Architect.
    b. If necessary, testing of the soil material components may be requested by the Landscape Architect to facilitate approval of the plant soil mix.
    c. As necessary, make any and all plant soil mix amendments and resubmit test reports indicating amendments until approved.

D. The Landscape Architect may request additional testing by the Contractor for confirmation of mix quality and/or plant soil mix amendments at any time until completion.

Planting Soil Supply:

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E. If any of the soil materials are not available from the supplier or are not in compliance with specifications herein, the Contractor shall obtain material from other suppliers and conduct tests specified herein to provide materials in compliance with these specifications.

F. The Soil Scientist and Landscape Architect shall be notified of all soil mix substitutions or problems with the planting soil supply in order to assist with a smooth delivery and installation.

Planting Soils:

G. Soil layer (S3): Planting Soil Drainage Layer consisting of a 6-inch layer of material with a USDA Texture of coarse sand.

a. Soil reaction with a pH between 4.5 – 7.0.
b. An estimated permeability of 20 - 25 cm/hour.
c. There shall be no visible organic material present in this layer.
d. Particle size distribution shall be:

S3 Soil Layer Particle Size Distribution

Particle Size Class	**Passing Sieve No**	**Range in Percent Passing** ASTM F 1632-03
fine gravel	10	95 – 100
very coarse sand	18	80 – 95
coarse sand	35	60 - 80
medium sand	60	10 – 40
fine sand	140	8 – 15
very fine sand	270	1 – 10
silt*		1 – 6
clay*		0 – 4
Organic Matter %	ASTM F 1647-02a	<0.25

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pH	1:1 Water	4.5 – 7.0

*determined by hydrometer method in ASTM F1632-03.

H. Soil layer (S2): A variable thickness layer of material with a USDA Texture of sand to loamy sand that has a maximum thickness of 24 inches. The thickness of the S2 is dependent on the soil profiles for individual planting areas, underground obstructions, and transition areas.

a. The soil specifications shall be that the minimum infiltration rate stays above 10 cm/hour (4 in/hr) after installation.
b. There should be no coarse fragments over 2.5 cm (1 in.) in size. The soil shall have soil moisture content less than 8% by weight for installation.
c. The S2 layer shall have a uniformly increasing with depth, penetration resistance of < 250 lbs/in^2 after installation.
d. The particle size distribution shall be:

S2 Soil Layer Particle Size Distribution

Particle Size Class	**Passing Sieve No**	**Range in Percent Passing** ASTM F 1632-03
fine gravel	10	95 – 100
very coarse sand	18	90 – 100
coarse sand	35	65 – 85
medium sand	60	30 – 40
fine sand	140	15 – 25
very fine sand	270	9 – 18
silt*		6 – 12
clay*		3 – 6

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Organic Matter %	ASTM F 1647-02a	3%
pH	1:1 Water	5.5 – 6.5
EC	1:1 paste	1.5 dS/m

*determined by hydrometer method in ASTM F1632-03.

I. Soil layer (S2 - G): Soil layer S2g shall have the same composition requirements as the S2 with the following modifications: to attain acceptable pH levels the soil mix may need treatment given that most recycled glass is made with soda-lime additives. The glass may require thorough washing to remove salts. Agricultural gypsum or sulfur treatment may be required to bring the soils into an acceptable pH range. The S2g shall be a variable thickness layer of material with a USDA Texture of sand to loamy sand that has a maximum thickness of 24 inches. The thickness of the S2g is dependent on the soil profiles for individual planting areas, underground obstructions, and transition areas.

J. Soil layer (S1): Planting Soil Surface layer. A layer consisting of material with a USDA Texture of sand to loamy sand (S2) amended with organic matter (must be tested to meet specifications after compost is approved and added).

a. The soil specifications shall be that the minimum infiltration rate for planting soil areas stays above 5 cm/hour (2 in/hr) after installation.
b. The soil shall have soil moisture content less than 8% by weight for installation.
c. The S1 layer shall have a uniformly increasing with depth, penetration resistance of < 120 lbs/in^2 after installation.
d. The particle size distribution shall be:

S1 Soil Layer Particle Size Distribution

Particle Size Class	**Passing Sieve No**	**Range in Percent Passing** ASTM F 1632-03
fine gravel	10	95 – 100
very coarse sand	18	90 – 100
coarse sand	35	65 – 85

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medium sand	60	30 – 40
fine sand	140	15 – 25
very fine sand	270	9 – 18
silt*		6 – 12
clay*		3 – 6
Organic Matter %	ASTM F 1647-02a	3 – 5%
pH	1:1 water	5.5 – 6.5
EC	1:1 paste	1.5 dS/m
Phosphorous (P)	extract	20 – 100 ppm
Potassium (K)	extract	200 – 600 ppm
Cation Exchange (CEC)	Extract	>8 Meq/100g

*determined by hydrometer method in ASTM F1632-03.

K. Soil layer (S1 - G): Soil layer S2g shall have the same composition requirements as the S1 layer with the following modifications: the pH may be alkaline given that most recycled glass is made with soda-lime additives. The glass fines should be washed and may require blending with agricultural gypsum or sulfur treatment may be required to bring the soils into an acceptable acid pH range.

Organic Amendment:

L. Composted Biosolid and municipal yard waste compost producers shall provide the heavy metal certificate of the material delivered as per EPA, New Jersey Division of Water Quality Bureau of Pretreatment and Residuals (BPR) and NJDEP standards. Composted organic matter shall have the following criteria:

Criteria	**Test Method**	**Acceptable Range**

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Type		brewer's waste, or leaf mulches are also acceptable. Composted municipal waste (chipped, shredded and screened wood, leaves, bark, etc.) alone is not acceptable unless it meets all of the criteria noted
Carbon/Nitrogen Ratio		11:1 – 22:1
Degree of Maturity	Dewer Self Heating or	VI – V
	Solvita Maturity Index or	6 – 8
	CO_2 Evolution	1.2 % C/day
Foreign Material	Dry wt.	< 1" dia. And < 2% (of total)
Organic Matter %	Dry wt.	25 – 55%
Reaction	1:1 water	5.5 – 8.0
Ammonium	extract	< 200 ppm
Salinity	1:1 paste	< 1.5 dS/m
Nutrient Content	extract	Contains some nitrogen, phosphorus, potassium, calcium, magnesium, sodium and micronutrients including iron, copper, boron, and manganese. Nutrients shall be present in appropriate agricultural and horticultural proportions to prevent ion antagonism.
Heavy Metals	extract	Concentrations of zinc, mercury, cadmium, lead, nickel, chromium, and copper must be below EPA and the BPR and NJDEP standards for

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		biosolid applications to soils with human activity.

Planting Soil Mix Equivalency Table:

M. The mix ratios below are rough estimates based on usual components found in the area and their physical properties. Slight adjustments to the mix may be needed to achieve the required planting soil properties.

Layer Designation	**Base Material or Equivalent**	**Second Soil Mix Component**	**Third Soil Mix Component**	**Mix Ratio (Volume)**
S3 Layer	USGA straight sand, non-calcareous Masonry Sand, or fine ground recycled glass cullet*	None	None	None
S2 Layer (Intermediate)	Approved S3 material	sandy loam*	None	3:1
		sandy clay loam*	None	5:1
		loam*	None	4:1
S2 – L (Reinforced Lawn)	S2 Soil blended with reinforcement Fibers	See S2	Reinforcement Fibers	Manufacturer's Instructions
S2 – S	S2 compacted to bearing load requirements	See S2		
S2 - G	Fine ground recycled glass cullet ǂ	sandy loam*	None	3:1
		sandy clay loam*	None	5:1

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		loam*	None	4:1
S1 Layer (Topsoil)	S2 planting soil mix	Approved Compost	None	4:1
S1 – L (Reinforced Lawn)	S1 Soil blended with Reinforcement Fibers	See S1	Reinforcement Fibers	Manufacturer's Instructions
S1 - B Layer Bio-filtration	Approved S1 material			**SEE NOTE**
S1 - G Layer	Glass Cullet material	Approved Compost	None	4:1

* - Soils as defined per USDA classifications of soil textures for sands, loams and clays.

ǂ - Recycled glass aggregate shall conform to a sieve range of a fine mason's sand – ASTM C-144 Sieve Range. This material may be obtained from suppliers of sand blasting media.

2.2 SOIL PROFILES

PROFILE 1 – Lawn Planting Profile: This planting soil profile is to be used strictly for high use lawn planting areas (See Soil Profile Detail Drawings). The profile consists of a single 6 inch layer of S1 over a 6 inch layer of S2 material placed on a correctly pitched subgrade (See Drawings) The basis for the S1 and S2 layers is the loamy sand specified in Part 2.1. This profile will be blended with a turf fiber reinforcement product according to selected manufacturer's instructions.

PROFILE 2 –Tree and Shrubs and Groundcovers: This planting soil profile consists of three soil horizons (See Soil Profile Detail Drawings). This soil profile shall be areas noted on the drawings that shall receive plantings in plant beds as indicated in the drawings. The A horizon (S1 layer) of 6 inches, the B horizon (S2 layer) of a maximum of 24 inches, and the drainage layer (S3 layer) of 6 inches over a scarified and correctly pitched subgrade. The basis for the S1 and S2 layers is the loamy sand specified in Part 2.1. The drainage layer (S3) is coarse sand specified in Part 2.1 of this section.

PART 3 EXECUTION

3.1 COORDINATION

Pre-Installation Examination Required: The Contractor shall examine previous work, related work, and conditions under which this work is to be performed and shall notify the Owner in writing of all

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deficiencies and conditions detrimental to the proper completion of this work. Beginning work means the Contractor accepts substrates, previous work, and conditions. The Contractor shall not place any planting soil until all work in adjacent areas is complete and approved by the Owner.

Planting Soil Preparation: Examine soil and remove foreign materials, stones over 1”, and organic debris over 2” in length. Mix-in amendments as required by tests and as approved by the Owner. All preparation and mixing shall be accomplished when the soil moisture content is less than 8 percent by volume.

Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities subsequent to placement.

3.2 EXCAVATION

Excavation of the soils shall be accomplished to a depths noted for each soil profile area. All construction debris shall be removed from the planting areas prior to placement of the soil layers. Care shall be taken to avoid working the soil when it has 8 percent moisture content or above.

A. Excavation Depths: (of the subgrade below final grade where applicable)
B. Tree Planting Areas shall be excavated to 36 inches below final grade.
C. Shrub and perennial areas shall be excavated to 18 inches below final grade.
D. Lawn Planting Areas shall be excavated to 12 inches below final grade.
E. See contract drawing details for soil depths in stormwater basins.

F. If unsuitable subgrade soils are encountered, consult the Owner's geotechnical consultants for directions on how to proceed.
G. If conflicts arise during excavation, notify the Landscape Architect in writing and make recommendations for action. Proceed with Work only when action is approved in writing.

H. Installation of Root Barriers

1. Install root barrier in accordance with manufacturer's installation instructions.

I. Installation of Planting Soil withing the Tree Planting Area

1. Remove rubble, debris, dust and silt from the top of the planting soil within the tree opening that may have accumulated after the initial installation of the planting soil within the Silva Cells.
2. Install additional planting soil within the tree openings, to the depths indicated on the Drawings.

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a. Use the same soil used within the Silva Cells for planting soil within the tree openings.

3. Compact planting soil under the tree root ball as needed to prevent settlement of the root ball.
4. Place trees in accordance with the Drawings.

J. Protection

1. Keep construction traffic away from the limits of the Silva Cells until the final pavement profile is in place. The Silva Cell system does not fully meet loading strength until the final paving is installed.
   a. Do not operate equipment directly on top of the Silva Cell system until paving installation has been completed.
   b. Provide fencing and other barriers to prevent vehicles from entering into the Silva Cell area.

2. When the Silva Cell installation is completed and the permanent pavement is in place, limit traffic and construction related activities to only loads less than the design loads.

3.3 MIXING OF TOPSOIL

The planting soil shall be mixed in a ball mill or tub mill fitted with proper screening and paddles. Windrowing the materials is not acceptable, as it does not produce uniform mixing of the components.

Mixing of the compost for the S1 layer (topsoil) shall be accomplished in the same manner as the other mixing procedures. The compost shall be moist, but not overly wet. Compost shall not be so wet as to have water squeezed out by hand or so dry as to by easily blown by wind.

3.4 PLACEMENT OF SOIL LAYERS (HORIZONS)

Examination of Subgrade: The subgrade shall be examined by the Contractor prior to the start of soil placement and planting. Any deficiencies shall be noted and related to the Owner in writing prior to acceptance of the subgrade by the Landscape Contractor:

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Planting Soil Placement:

A. General Lawn Soil Profile Placement: For areas designated PROFILE 1(See Drawings)

   a. Place the S3 drainage layer in one 6 inch lift. Compaction of this lift shall consist of light tamping by the installers foot traffic. No mechanical compaction shall be allowed.
   b. Place the S1 mix in a one 6-8 inch lift, ensuring that the soil is graded uniformly, then seed or sod as per the specifications.

B. Tree Profiles: For areas designated PROFILE 2 (See Drawings)

   a. Installation of planting soils shall be accomplished with small tracked equipment. Back-blading is strictly forbidden as it will overly compact the delicate planting soil. If planting soil has been kept dry and the subgrade is not saturated, installation of the designed planting soil can continue the day after a rain event, unless the subgrade is considerably saturated or has standing water.
   b. Where applicable, place the S3 drainage layer in one 6 inch lift. Compaction of this lift shall consist of light tamping by the installers foot traffic. No mechanical compaction shall be allowed except where otherwise noted.
   c. Trees and large shrubs shall be installed with these procedures for soil installation and planting. These trees and large shrubs shall be planted after the S2 layer is installed, but prior to the S1 layer installation.
      1) Compact a pedestal of S2 material to 90 percent of Standard Proctor at below optimum moisture then lightly scarify the pedestal surface.
      2) The soil depth shall be so that the root flair of the tree will be 1 to 2 inches above final grade.
      3) Install the 6 to 8 inches of the S1 layer after all plantings have been completed.
   d. Where applicable, place 24 inches of the S2 layer where the soil installation shall not exceed 6 inches lifts. The thickness of the S2 layer shall be thickened or thinned to maintain final grade. Light foot traffic and tracked light equipment is allowable for placing the next lift and is needed to seat the soil layers within the profile thus reducing overall subsidence. A light scarification of the surface of each lift with hand tools is required to break up any compacted surface and eliminate any compaction interface. Higher traffic areas will require greater amounts of scarification. Additional compaction is prohibited except where noted.
   e. Care shall be taken to maintain the separation between the designed soil layers. Do not mix the S1, S2 or S3 with adjacent layers.

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f. Reducing the amount of compaction to the soils can be accomplished by beginning the work in corners, against walls, or at the center of isolated beds, and progressing outwards. This limits the amount of traffic needed for installation on the placed soil.
g. Planting soils shall never be moved or worked when wet or frozen.
h. Penetration resistance shall not exceed 200 lbs/ft^2 within the S2 and the resistance for the S1 layer shall be less than 120 lbs/ft^2 except where otherwise noted (under pavement plantings). The planting soil shall be uniformly increasing in density with depth. There shall not be any compacted layers within the soil profile.
i. The Contractor shall place barricades as required to prevent any unnecessary compaction of S2 layer from vehicles, equipment, or pedestrian traffic during construction and vegetation establishment. Any additional compaction of the planting soils must be loosened satisfactorily to meet penetration resistance specifications.

C. : For areas designated PROFILE 3 (See Drawings)

a. Scarify the subgrade to a depth of 4 to 6 inches
b. Place the S3 drainage layer in one 6 inch lift over the subgrade that is correctly pitched to the underdrainage piping. Compaction of this lift shall consist of light tamping by the installers foot traffic. No mechanical compaction shall be allowed except where otherwise noted.
c. Place 24 inches of S2 material in 6 inch lifts Compact each lift to 90 percent of Standard Proctor below optimum moisture. DO NOT compact soils above optimum moisture content.
d. Scarify each lift surface before applying additional lifts to a depth of 1-2 inches. The final lift below the cobblestone pavement shall compacted to 90% and shall not be scarified.
e. Place approved Geotextile, on the S2 surface in the areas noted on the drawings before placing the gravel base layer for concrete sidewalks. Ensure that the Geotextile is folded back onto the gravel base and away from the planting areas.

D. Complete all hardscape construction after installation of the S2 layer and Clean Subsoil has occurred.

a. Limit all traffic during construction to areas designated for hardscape placement.
b. After hardscape construction is complete, the S2 layer and Clean Subsoil shall be scarified to loosen compacted areas adjacent to where construction occurred. Penetration resistance shall not exceed 200 lbs/ft^2 except where noted. Resistance shall be uniformly increasing with depth.

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c. The scarification shall be such that care is taken not to damage the hardscape.
d. The depth of the scarification shall be 2 to 3 inches. Deeper loosening may be required if compaction is extensive. Test with cone penetrometer.
e. Scarify any other areas that have been compacted prior to S1 layer or Topsoil placement.

CONSTRUCTION NOTE: All utility boxes and structures that will be placed completely within the designed soil shall require compacted pedestals at 90% of Standard Proctor to support the structures.

3.5 PROTECTION AND REPAIRS

Protect newly graded areas from traffic, freezing and erosion. Keep free of trash, debris or construction materials. Landscape contractor shall be the only personnel allowed on areas where planting soil has be installed.

Within the installation warranty period repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or compacted due to subsequent construction operations or weather conditions.

Scarify or remove and replace material to a depth as directed by the Owner; reshape and re-compact by only hand tamping at the prescribed moisture content.

Where settling occurs, before sidewalk construction and final soil installation acceptance, backfill with additional approved material, compact to specified rates, and restore any disturbed areas to a condition acceptable to the Owner.

3.6 POST INSTALLATION MAINTENANCE

Where settling occurs, backfill with additional approved material, compact to specified rates, and restore any disturbed areas to a condition acceptable to the Owner.

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A. Any post installation changes or amendments to previously approved soils without the Landscape Architect’s consent are the responsibility of the Owner.

END OF SECTION

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SECTION 32 92 10 – TURF AND GRASSES

PART 1 GENERAL

SECTION 32 92 10 – TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Seeding.
2. Preparing subgrade.
3. Soil amendments
4. Mulching.
5. Protecting and maintaining all seeded areas until Substantial Completion.
6. Erosion-control material(s).
7. Final Clean-up.
8. Sodding.
9. Hydroseeding.
10. Plugging.
11. Sprigging.
12. BMP Seeding.

Related Sections:

13. Division 32 Section 32 91 00, "Planting Soil"

1.3 DEFINITIONS

A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
B. Finish Grade: Elevation of finished surface of planting soil.
C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or

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mitigating a pest. For use in this specification, synthetic chemical insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides are not acceptable. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

F. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.

H. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

I. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project. Any use of such products must comply with integrated pest management criteria.
2. Mulch(s)
3. Erosion control netting
4. Commercial fertilizer

B. Samples for Verification:

Mulch: Two (2) pound bag of each type.
Erosion control netting: 12" x 12" piece.

C. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

D. Schedule and Work Plan: Submit detailed schedule and Work plan, indicating location and installation dates for each area of lawn.

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1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified landscape Installer.

B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf establishment.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.

2. Experience: Five years' experience in turf installation in addition to requirements in Division 01 Section "Quality Requirements."

3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

4. Personnel Certifications: Installer’s field supervisor shall have certification in one of the following categories from the Professional Landcare Network:

Certified Landscape Technician - Exterior, with installation, maintenance, irrigation specialty area(s), designated CLT-Exterior.

Certified Turfgrass Professional, designated CTP.

Certified Turfgrass Professional of Cool Season Lawns, designated CTP-CSL.

5. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

6. Pesticide Applicator: State licensed, commercial.

B. Preinstallation Conference: Conduct conference at Project site.

C. Installer: Perform work with personnel totally familiar with lawn construction under the supervision of an experienced landscape foreman at all times during the construction. Notify the Landscape Architect of the name and phone number of the foreman five (5) business days in advance of the first day of lawn construction.

D. Arrange a preconstruction meeting between the Landscape Architect, General Contractor and

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Lawn Subcontractor. Such meeting shall seek to review the lawn construction schedule, phasing, review of specifications and construction procedures.

1.7 REGULATORY REQUIREMENTS

A. Comply with all rules, regulations, laws and ordinances of local, state and federal authorities having jurisdiction. Provide labor, materials, equipment and services necessary to make Work comply with such requirements without additional cost to Owner.

B. Investigate the conditions of public thoroughfares and roads as to availability, clearances, loads, limits, restrictions, and other limitations affecting transportation to and ingress and egress at the site. Conform to all governmental regulations regarding the transportation of materials. Procure and pay for permits and licenses required for Work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.

2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.

3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

1.9 PROJECT CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion

1. Seeding

a. Spring: April 1 to May 15.

b. Fall: August 15 to September 30.

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B. Existing Conditions

1. Carefully examine the site before submitting a bid. Be informed as to the nature and location of the Work, general and local conditions including climate, adjacent properties and utilities, conformation of the ground, the nature of subsurface conditions, the character of equipment and facilities needed prior to and during execution of the Work.

2. Should the Contractor, in the course of Work, find any discrepancies between Drawings and physical conditions or in layout as furnished by the Landscape Architect, inform the Landscape Architect immediately in writing for clarification. Work done after such discovery, unless authorized by the Landscape Architect, shall be done at the Contractor's risk.

C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions. Do not seed when the ground is frozen, or the soil is otherwise in an unsatisfactory condition for lawn construction.

1.10 MAINTENANCE SERVICE

A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:

1. Seeded Turf: 60 days from date of Substantial Completion.

2. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

B. Maintain all lawn areas until Substantial Completion. Maintenance will be in accordance with requirements specified in Part 3 of this Section.

1. The Landscape Architect will make an inspection for Substantial Completion of the Work of this Section at the time of Substantial Completion of the entire Contract. The Contractor shall furnish a full and complete written program for maintenance of the lawns for review by the Landscape Architect at the time of the request for Substantial Completion.

2. Submit a written request for inspection at least two (2) weeks prior to the day on which

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the inspection is requested.

3. The Contractor shall prepare a list of items to be completed or corrected for review by the Landscape Architect, prior to inspection.

4. All lawns shall show a uniform, thick, well developed stand of grass. If the grass stand is unsatisfactory, as determined by the Landscape Architect, the Contractor's maintenance responsibility shall continue until an acceptable stand of grass is achieved.

C. Upon completion of the inspection, the Landscape Architect shall amend the list of items to be completed or corrected, and indicate the time period for their completion or correction.

D. Lawns will not be accepted until all items have been completed or corrected. The Landscape Architect, after an additional inspection, shall recommend in writing the Substantial Completion of the Work of this Section. The Contractor's responsibility for maintenance shall terminate, under issuance of a certificate of Substantial Completion for the entire Contract.

E. In addition to the specific guarantee requirements of the General Conditions and Supplementary General conditions, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

PART 2 PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species: State-certified seed of grass species as follows:

1. Sun and Partial Shade: Proportioned by weight as follows:

a. Kentucky bluegrass (Poa pratensis) (50%)

b. Chewings red fescue (Festuca rubra variety). (30%)

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c. Quickguard (Sterile Triticale Hybrid) (10%)

d. Redtop (Agrostis alba) (10%)

C. Seed shall be fresh, clean, new crop seed. The Contractor shall furnish to the Landscape Architect the dealer's guaranteed statement of the composition of the mixture and the percentage of purity and germination of each variety.

D. Seed shall not contain in excess of 1.0% weed seed. Seed containing prohibited or restricted noxious weeds will not be accepted, and shall comply with state laws governing noxious weeds.

1. The following noxious weeds are prohibited from any mix: Bindweed, Canada Thistle, quackgrass, hedge kind weed, horse nettle, wild garlic bermuda grass, cheat, wild onion, corn cockle, dodder and wild onion, Johnsongrass, perennial sweet sudan grass, sorghum hybrids.

E. Purchase seed from a recognized distributor.

2.2 MULCH

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.

2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.

3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.

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4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Landscape Architect and replace with new planting soil.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

A. Limit turf subgrade preparation to areas to be planted.

B. Newly Graded Subgrades: Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Spread, blend and mix planting soil as indicated in Section 32 91 00, “Planting Soil".

C. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:

1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.

2. Loosen surface soil to a depth of at least 12 inches. Apply soil amendments as necessary. Till soil to a homogeneous mixture of fine texture.

3. Remove stones larger than 1” in any dimension and sticks, roots, trash, and other extraneous matter.

4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.

D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly

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fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

E. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

F. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

A. Prepare area as specified in "Turf Area Preparation" Article.

B. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.

C. Fill cells of erosion-control mat with planting soil and compact before planting.

D. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.

E. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.5 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.

1. Do not use wet seed or seed that is moldy or otherwise damaged.

2. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total rate of 5 to 8 lb/1000 sq. ft.

C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

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D. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets and 1:6 with erosion-control fiber mesh installed and stapled according to manufacturer's written instructions.

E. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

2. Bond straw mulch by spraying with non-toxic natural emulsion at a rate approved by manufacturer. Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.

F. Protect seeded areas from hot, dry weather or drying winds by applying planting soil within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

3.6 TURF MAINTENANCE

A. Maintenance shall begin immediately after each portion of lawn is installed

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.

2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.

3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches (100 mm).

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.

2. Water turf with fine spray at a minimum rate of 1 inch (25 mm) per week unless rainfall precipitation is adequate.

C. Lawn work shall be maintained on daily basis, weekends and holidays excluded, except as

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otherwise required herein, until Substantial Completion.

D. Mow turf as soon as top growth reaches between 3-1/2 and 4 inches. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. First and last cut of the season shall be cut low to 1-1/2 inches.

2. Routine mowing of turf to a height of 3 to 3-1/2 inches.

3.7 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Landscape Architect:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.

B. Scattered bare or dead spots, none of which are larger than 36 square inches, will be allowed up to a maximum of two percent (2%) of any lawn area after initial installation. After the grass has been established, all areas which fail to show a uniformly thick and well developed stand of grass and all scattered base or dead spots, for any reason whatsoever, shall be reseeded repeatedly until all areas are covered with a satisfactory growth of grass. Lawn areas shall show no joints or dead spots at Substantial Completion and shall be anchored to lawn mix bed with vigorous, healthy root growth. Prior to Substantial Completion, damage resulting from erosion, gulleys, washouts or other causes shall be repaired by filling with lawn mix, tamping, re-fertilizing and re-seeding.

C. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

D. Add organic fertilizer if soil tests indicate deficiency.

3.8 PROTECTION OF LAWN AREAS

A. Protect all lawn areas continuously against damage with a fence as specified. Maintain continuously in a condition acceptable to the Landscape Architect. Remove fence and any protective devices remaining on site after Substantial Completion unless directed otherwise by the Landscape Architect.

B. Contractor shall pay cost of replacement of lawn areas except where it can be definitely shown that the loss resulted from vandalism or deleterious effects caused by maintenance

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procedures performed by the Owner without the concurrence of the Contractor. Fully restore all lawn areas, damaged or disturbed by replacement or repair operations to their original condition.

3.9 WATERING

A. The Contractor shall provide all labor and arrange for all watering necessary for establishment of lawn areas. In the absence of adequate rainfall, watering shall be performed daily or as often as necessary and in sufficient quantities to maintain moist soil to a depth of at least four (4) inches.

3.10 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

C. Remove nondegradable erosion-control measures after grass establishment period.

D. Maintain the site in an orderly condition during the progress of Work. Continuously and promptly remove excess and waste materials; keep lawn areas, walks and roads clear. Store materials and equipment where directed. Immediately remove rejected materials from the property. Promptly remove equipment, surplus material, and debris and trash resulting from operations under this Contract upon completion and prior to inspection of Work. Leave the site in a neat, orderly condition, "broom clean".

END OF SECTION

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SECTION 32 93 10 – EXTERIOR PLANTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Procure, deliver and install all specified plants.
2. Water all specified plants.
3. Mulch, stabilize and prune all specified plants.
4. Maintenance of all specified plants prior to final acceptance.
5. Clean up and disposal of all excess and surplus material.

B. Related Sections:
1. Division 32 Section 32 91 00, "Planting Soil"
2. Division 32 Section 32 92 10, "Turf and Grasses."

1.3 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with ball size not less than sizes indicated; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1. Field grown trees (B&B) are growing in field soil for at least 12 months prior to harvest.
C. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for type and size of plant required.
D. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

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E. Defective Plant: Any plant that fails to meet the plant quality requirement of this specification.
F. End of Final Acceptance: The date when the Owner's Representative accepts that the plants and work in this section meet all the requirements of the contract.
G. Finish Grade: Elevation of finished surface of planting soil.
H. Healthy: Plants that are growing in a condition that expresses leaf size, crown density, color; and with annual growth rates typical of the species and cultivar's horticultural description, adjusted for the planting site soil, drainage and weather conditions.
I. Kinked Root: A root within the root package that bends more than 90 degrees.
J. Maintenance: Actions that preserve the health of plants after installation and as defined in the maintenance specification.
K. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
L. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. For use in this specification, synthetic chemical insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides are not acceptable. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
M. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
N. Planting Area: Areas to be planted.
O. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
P. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
Q. Reasonable and Reasonably: When used in this specification relative to plant quality, it is intended to mean that the conditions cited will not affect the establishment or long-term stability, health or growth of the plant. This specification recognizes that it is not possible to produce plants free of all defects, but that some accepted industry protocols and standards result in plants unacceptable to this project. When reasonable or reasonably is used in relation to other issues such as weeds, diseased, insects, it shall mean at levels low enough that no treatment would be required when applying recognized Integrated Plant Management practices. This specification recognizes that some decisions cannot be totally based on measured findings and that professional judgment is required. In cases of differing opinion, the Owner's Representative's expert shall determine when conditions are judged as reasonable.
R. Root Ball: The mass of roots including any soil or substrate and any packaging in place for shipping.

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S. Root Collar (root crown, root flare, trunk flare, flare): The region at the base of the trunk where the majority of the structural roots join the plant stem, usually at or near ground level.
T. Shrub: Woody plants with mature height approximately less than 15 feet.
U. Stem: The trunk of the tree.
V. Stem Girdling Root: Any root more than ½" inch diameter currently touching the trunk, or with the potential to touch the trunk, above the root collar approximately tangent to the trunk circumference or circling the trunk. Roots shall be considered as Stem Girdling that have, or are likely to have in the future, root to trunk bark contact.
W. Structural Root: One of the largest roots emerging from the root collar.
X. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
Y. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
Z. Substantial Completion Acceptance: The date at the end of the Planting, Planting Soil, and Irrigation installation where the Landscape Architect accepts that all work in these sections is complete and maintenance period has begun. This date may be different than the date of substantial completion for the other sections of the project.
AA. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.
BB. Tree: Single and multi-stemmed plants with mature height approximately greater than 15 feet.

1.4 REFERENCES

A. ANSI Z60.1 – American Standard for Nursery Stock, most current edition.
B. SPN: "Standardized Plant Names," latest edition, by the American Joint Committee on Horticultural Nomenclature.
C. ANSI A 300 – Standard Practices for Tree, Shrub and other Woody Plant Maintenance, most current edition and parts.
D. Pruning practices shall conform to recommendations "Structural Pruning: A Guide For The Green Industry" most current edition; published by Urban Tree Foundation, Visalia, California.
E. Glossary of Arboricultural Terms, International Society of Arboriculture, Champaign IL, most current edition.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Provide submittals eight weeks prior to installation of plants.
    1. Approval by the Landscape Architect of submitted product data, samples, test

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reports, and certificates, or plants inspected at source of supply, does not constitute final acceptance.

2. Plant sources:
    a. Submit proposed sources for all plants within 90 days of award of contract. Provide name and location of nursery, contact person, and telephone number, and a list of the plants they will provide. The plant list shall include the botanical and common name and the size at the time of selection. Observe all nursery materials to determine that the materials meet the requirements of this section.
    b. Where requested by the Landscape Architect, submit photographs of plants or representative samples of plants. Photographs shall be legible and clearly depict the plant specimen. Each submitted image shall contain a height reference, such as a measuring stick. The approval of plants by the Landscape Architect via photograph does not preclude the Landscape Architect right to reject material while on site.

B. Samples for Verification: Submit samples of each product and material where required by the specification. Label samples to indicate product, characteristics, and locations in the work. Samples will be reviewed for appearance only. Compliance with all other requirements is the exclusive responsibility of the Contractor.
    1. Organic Mulch: 1-pint (0.5-liter) volume of each organic mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.

C. Test Reports: Submit certified reports by an agricultural chemist. Make submittals at least three (3) weeks prior to delivery of materials to site.

D. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:

    1. Manufacturer's certified analysis of standard products.
    2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
    3. Plants: Furnish certificates of inspection as may be required by Federal, State or other authorities that plants are free of disease or hazardous insects.

E. Schedule and Work Plan: Submit detailed schedule and Work plan, indicating start and finish dates of planting activities, including layout, soil preparation, delivery of plants from nursery sources, excavation, and installation. If planting work is being installed in phases, submit plan with definable areas outlined and keyed, and provide schedule for planting work within each area. Provide submittal 8 weeks before the installation of plants.

F. Maintenance Program: Submit full and complete written program for maintenance of the planting as per the provided Landscape Maintenance Specification. Submit schedule/work plan for how maintenance will be managed prior to inspection for substantial completion.

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1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

1.7 QUALITY ASSURANCE

A. The Contractor is solely responsible for quality control of the work.
B. The same firm shall install new soil and plant material.
C. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants. Provide references of past projects, employee training certifications that support that the Contractor meets all qualifications and applicable licensures.
   1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
   2. Experience: Five (5) years' experience in landscape installation of similar size, scope and complexity, including planting of large specimen trees in urban areas and engineered soil, in addition to requirements in Division 01 Section "Quality Requirements."
   3. Installer's Field Supervision: When any planting work is in progress, installer shall maintain, on site, a full-time supervisor who can communicate in English with the Landscape Architect.
   4. Installer’s field supervisor shall have a minimum of five (5) years’ experience as a field supervisor installing plants and trees of the quality and scale of the proposed project.
   6. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:
      a. Certified Landscape Technician - Exterior, with installation specialty area(s), designated CLT-Exterior.
      b. Certified Ornamental Landscape Professional, designated COLP.
   7. The installer’s crew shall have a minimum of three (3) years experienced in the installation of Planting Soil, Plantings, and Irrigation (where applicable) and interpretation of soil plans, planting plans and irrigation plans.
   8. Pesticide Applicator: State licensed, commercial.

D. Plants: Meet or exceed applicable ANSI Z60.1 standards.

   1. Plant List: Investigate sources of supply prior to submitting bid. Confirm that size, variety and quantity of plants specified on Plant List can be supplied. Failure to

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take this precaution will not relieve the successful bidder from his responsibility for furnishing and installing all plants in strict accordance with the Contract requirements and without additional expense to the Owner.

a. Submit all requests for substitutions of plant species, or size to the Landscape Architect, for approval, prior to purchasing the proposed substitution. Request for substitution shall be accompanied with a list of nurseries contacted in the search for the required plant and a record of other attempts to locate the required material. Requests shall also include sources of plants found that may be of a smaller or larger size, or a different shape or habit than specified, or plants of the same genus and species but different cultivar origin, or which may otherwise not meet the requirements of the specifications, but which may be available for substitution. Equitable adjustment of the Contract Price will be considered.

2. Trees and Shrubs: Measure according to ANSI Z60.1. Do not prune to obtain required sizes. Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.

3. Other Plants: Measure with stems, petioles, and foliage in their normal position.

E. Arrange a preconstruction meeting between the Landscape Architect, General Contractor and Planting Subcontractor at least seven (7) days before beginning work. Such meeting shall seek to review any questions the Contractor may have regarding the work, administrative procedures during construction, project work schedule, general review of specifications and planting procedures.

1. Notify the Landscape Architect of the name and phone number of the foreman five (5) business days in advance of the first day of planting operations.

1.8 PLANT SELECTION AND INSPECTION

A. Landscape Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and to reject unsatisfactory or defective material at any time during delivery and installation.

B. The Landscape Architect may review all plants subject to approval of size, health, quality, character, etc. Review or approval of any plant during the process of selection, delivery, installation and establishment period shall not prevent that plant from later rejection in the event that the plant quality changes or previously existing defects become apparent that were not observed.

C. Plant Selection: The Landscape Architect reserves the right to select and observe all plants at the nursery prior to delivery and to reject plants that do not meet specifications as set forth in this specification. If a particular defect or substandard element can be corrected at the nursery, as determined by the Landscape Architect, the agreed upon remedy may be

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applied by the nursery or the Contractor provided that the correction allows the plant to meet the requirements set forth in this specification. Any work to correct plant defects shall be at the contractor's expense. Corrections are to be undertaken at the nursery prior to shipping.

D. The Landscape Architect may make invasive observation of the plant's root system in the area of the root collar and the top of the root ball in general in order to determine that the plant meets the quality requirements for depth of the root collar and presence of roots above the root collar. Such observations will not harm the plant.

E. Trees shall be purchased from the growing nursery. Re-wholesale plant suppliers shall not be used as sources unless the Contractor can certify that the required trees are not directly available from a growing nursery. When Re-wholesale suppliers are utilized, the Contractor shall submit the name and location of the growing nursery from where the trees were obtained by the re-wholesale seller. The wholesale nursery shall be responsible for any required plant quality certifications.

F. All plants specified as ball and burlap (B&B) must be in the ground at the growing source at the time of inspection. Pre-dug material will not be accepted.

G. Arrange for adequate manpower and equipment on site at the time of plant inspection and installation to provide a complete staked layout and to unload, open and properly handle plants during inspection.

H. Any plant rejected at the project site shall be immediately removed from the site and acceptable replacement plants provided at no cost to the Owner.

1.9 DELIVERY, STORAGE AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened clearly marked containers showing net weight, guaranteed analysis and name of manufacturer. Specified requirements for packaged materials apply to bulk shipments. Protect materials from deterioration during delivery and during storage at site. Upon delivery to the site, request, in writing, inspection of materials by Owner's representative and by Landscape Architect.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

C. Plants:

1. Notify the Landscape Architect seven (7) days in advance of any delivery of plants to the site.

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2. Protect materials from deterioration during delivery and storage. Adequately protect plants from drying out, exposure of roots to sun, wind or extremes of heat and cold temperatures. If planting is delayed more than 24 hours after delivery, set plants in a location protected from sun and wind.
   a. Provide adequate water to the root ball during the shipping and storage period.
   b. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray.
   c. Set plants in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage and keep roots moist, on the ground well protected with soil, straw, hay or other acceptable material. Adequately cover all roots of bare root material with soil, wet straw, hay or other acceptable material. Protect balls and roots and container grown material from freezing, sun, drying winds, and/or mechanical damage. Water as necessary until planted.
   d. Heeling in of plants shall not be allowed for more than two (2) days without approval of the Landscape Architect.
   e. All plant materials must be available for observation prior to planting.
   f. Using a soil moisture meter, periodically check the soil moisture in the root balls of all plants to assure that the plants are being adequately watered. Volumetric soil moisture shall be maintained above wilting point and below field capacity for the root ball substrate or soil.
3. Dig and handle plants with care to prevent injury to trunks, branches and roots. Handle planting stock by root ball.
4. Deliver bare-root stock plants freshly dug. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.
5. Do not prune prior to delivery, except for removal of broken, crossing or rubbing or to subordinate co-dominate leaders to create a central leader. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such manner as to damage bark, break branches or destroy natural shape. Pack and ship to insure arrival at site in good condition. Provide protective covering during delivery. No plants will be accepted if ball is cracked or broken.
6. Deliver trees and shrubs after preparations of planting areas have been completed and approved and plant immediately.
7. Immediately remove rejected plants from the site.
8. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F (16 to 18 deg C) until planting.
9. Heel-in bare-root stock. Soak roots that are in dry condition in water for two hours. Reject dried-out plants.
10. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist

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spray. Water as often as necessary to maintain root systems in a moist, but not overly-wet condition.

1.10 PROJECT CONDITIONS

A. Existing Conditions

1. Carefully examine the site before submitting a bid. Be informed as to the nature and location of the Work, general and local conditions including climate, adjacent properties and utilities, conformation of the ground, the nature of subsurface conditions, the character of equipment and facilities needed prior to and during execution of the Work.
2. Should the Contractor, in the course of Work, find any discrepancies between Drawings and physical conditions or any omissions or errors in Drawings, or in layout as furnished by the Landscape Architect, it will be his duty to inform the Landscape Architect immediately in writing for clarification. Work done after such discovery, unless authorized by the Landscape Architect, shall be done at the Contractor's risk.

B. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

C. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of each service or utility.
2. Do not proceed with interruption of services or utilities without Owner's written permission.

D. Planting Restrictions: Planting shall only be performed when weather and soil conditions are suitable for planting the materials specified in accordance with locally accepted practice. Install plants during the planting time as described below unless otherwise approved in writing by the Landscape Architect. In the event that the Contractor requests planting outside the dates of the planting season, approval of the request does not change the requirements of the contract.

1. Spring planting season shall be from March 15 to May 31.
2. Fall planting season shall be from September 15 to December 15.
3. The following specified plants are commonly known to have fall digging hazard traits or need for careful handling due to thin bark and shall be dug when plants are completely dormant and planted during spring season:
    a. Acer rubrum
    b. Betula nigra

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c. Carpinus caroliniana
d. Cornus florida
e. Halesia carolina
f. Liquidambar styraciflua
g. Nyssa sylvatica
h. Taxodium distichum

4. Plant bare root whips and shrubs in the spring only, when dormant, as close to April 1 as possible.
5. Plant bulbs between September 1 and November 15, as soon as they become available from suppliers.
6. Plant perennials as soon as the ground is workable in spring and according to planting restriction listed above.

E. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements. No planting shall take place during extremely hot, dry, windy or freezing weather.

F. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.

1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

G. The Contractor shall coordinate with all other work that may impact the completion of the work. Prior to the start of work, prepare a detailed schedule of the work for coordination with other trades.

H. Coordinate work with the installation of irrigation lines, heads or the conduits of other utility lines, avoid conflict with tree locations. Root balls shall not be altered to fit around lines. Notify the Owner' Representative of any conflicts encountered.

1.11 INSPECTION FOR SUBSTANTIAL COMPLETION

A. Maintain all plants until Substantial Completion and beginning of maintenance period.

B. The Landscape Architect, with the Contractor and the Owner's Representative, will make an inspection for Substantial Completion of the Work of this Section.

1. Submit a written request for inspection at least two (2) weeks prior to the day on which the inspection is requested.
2. All planting shall be alive, healthy and installed as specified to be accepted.
3. Prepare a list of items to be completed or corrected for review by the Landscape Architect.

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C. Upon completion of the inspection, the Landscape Architect shall amend the list of items to be completed or corrected, and indicate the time period for their completion or correction.

D. The Landscape Architect will make another inspection after notification from the Contractor that all items have been completed and corrected. If the work is complete and acceptable, the Landscape Architect will certify in writing to the Owner the Substantial Completion of the Work. The maintenance period will not begin until certification is received from the Owner.

1.12 PLANT MAINTENANCE PRIOR TO SUBSTANTIAL COMPLETION

A. During the project work period and prior to Substantial Completion Acceptance, the Contractor shall maintain all plants.

1.13 SUBSTANTIAL COMPLETION ACCEPTANCE

A. Upon written notice from the Contractor, the Landscape Architect shall review the work and make a determination if the work is substantially complete.

1. Notification shall be at least seven (7) days prior to the date the Contractor is requesting the review.

B. The date of substantial completion of the planting shall be the date when the Landscape Architect accepts that all work in Planting, Planting Soil, and Irrigation installation sections is complete.

C. The Maintenance Period begins at date of written notification of Substantial Completion from the Landscape Architect. The date of Substantial Completion may be different than the date of substantial completion for the other sections of the project.

1.14 GUARANTEE

A. Contractor is not responsible for acts of vandalism occurring after the beginning of Guarantee Period, nor shall Contractor be held responsible for deleterious effects caused by maintenance procedures performed by the Owner without the concurrence of the Contractor or caused by Owner's failure to follow maintenance program.

B. During this time the Owner shall maintain all plants; however, during the Guarantee Period it shall be the Contractor's responsibility to inspect the plants to satisfy himself that the areas are receiving proper care.

1. If the Contractor is of the opinion that the care being given the plants by the Owner is insufficient or may cause them to die prematurely, he shall immediately, and in sufficient time to permit the condition to be satisfactorily rectified, notify the

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Landscape Architect in writing; otherwise no consideration will be given to his claim at a later date.

C. Guarantee for plants other than herbaceous material:

1. Replace at no additional cost for a period of two (1) years after the establishment of the beginning date of Guarantee Period, any trees, shrubs, or ground covers that have died or that are, in the opinion of the Landscape Architect, in unhealthy or unsightly condition, or that have lost their natural shape due to dead branches, excessive pruning, excessive defoliation, or inadequate or improper maintenance.
   a. Replace unacceptable plants no later than the next succeeding planting season.
   b. Replace unacceptable plants in accordance with original Specification. Cost is considered to be included in the Bid and Contract price. Guarantee all replaced material for a period of one (1) year from date of replacement.
   c. Deciduous trees larger than 3 inches in caliper shall be guaranteed for a period of two (2) years.

D. Guarantee for herbaceous plants
   1. Perennials and Bulbs
      a. Guarantee to show signs of healthy growth in the succeeding blooming season.

1.15 FINAL ACCEPTANCE

A. The Landscape Architect will make an inspection for Final Acceptance of the Work of this Section at the end of the Guarantee Period.
   1. Submit a written request for inspection at least two (2) weeks prior to the day on which the inspection is requested.
   2. All planting shall be alive, healthy and maintained as specified to be accepted.

B. Upon completion of the inspection, the Landscape Architect will submit to the Owner a list of items to be completed or corrected and indicate the time period for their completion or correction.

C. The Final Acceptance will not occur until all items have been completed or corrected. The Landscape Architect after additional inspection, will recommend in writing to the Owner Final Acceptance of the Work. Final Acceptance will be certified in writing by the Owner.

PART 2 PRODUCTS

2.1 PLANTING PIT MATERIALS

A. A. Soil and Soil Mixes: See Division 32 Section – “Planting Soil.”

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2.2 PLANTS, GENERAL

A. Standards and measurement: Provide plants of quantity, size, genus, species, and variety or cultivars as shown and scheduled in contract documents.
   1. All plants including the root ball dimensions or container size to trunk caliper ratio shall conform to ANSI Z60.1 “American Standard for Nursery Stock” latest edition, unless modified by provisions in this specification. When there is a conflict between this specification and ANSI Z60.1, this specification section shall be considered correct.

B. Plants larger than specified may be used if acceptable to the Owner’s Representative. Use of such plants shall not increase the contract price. If larger plants are accepted the root ball size shall be in accordance with ANSI Z-60.1. Larger plants may not be acceptable if the resulting root ball cannot be fit into the required planting space.

C. Compliance: All trees shall comply with federal and state laws and regulations requiring observation for plant disease, pests, and weeds.

D. Proper Identification: All trees shall be true to name as ordered or shown on planting plans and shall be labeled individually or in groups by genus, species, variety and cultivar.

E. Plant Quality:

   1. General: Provide healthy stock, grown in a nursery and reasonably free of die-back, disease, insects, eggs, bores, and larvae. At the time of planting all plants shall have a root system, stem, and branch form that will not restrict normal growth, stability and health for the expected life of the plant
   2. Plant quality above the soil line:
      a. Plants shall be healthy with the color, shape, size and distribution of trunk, stems, branches, buds and leaves normal to the plant type specified.
   3. Plant quality at or below the soil line:
      a. Plant roots shall be normal to the plant type specified. Root observations shall take place without impacting tree health.

F. Balled and Burlapped Plants
   1. All Balled and Burlapped Plants shall be field grown, and the root ball packaged in a burlap and twine and/or burlap and wire basket package.
   2. Plants shall be harvested with the following modifications to standard nursery practices.
      a. Prior to digging any tree that fails to meet the requirement for maximum soil and roots above the root collar, carefully remove the soil from the top of the root ball of each plant, using hand tools, water or an air spade, to locate the root collar and attain the soil depth over the structural roots requirements. Remove all stem girdling roots above the root collar. Care must be exercised not to damage the surface of the root collar and the top of the structural roots.

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3. Trees shall be dug for a minimum of 4 weeks and a maximum of 12 weeks prior to shipping. Trees dug 4 to 12 weeks prior to shipping are defined as hardened-off. Digging is defined as cutting all roots and lifting the tree out of the ground and either moving it to a new location in the nursery or placing it back into the same hole. Trees that are stored out of the ground shall be placed in a holding area protected from extremes of wind and sun with the root ball protected by covering with mulch or straw and irrigated sufficiently to keep moisture in the root ball above wilt point and below saturation.
4. If wire baskets are used to support the root ball, a “low profile” basket shall be used. A low profile basket is defined as having the top of the highest loops on the basket no less than 4 inches and no greater than 8 inches below the shoulder of the root ball package.
    a. At nurseries where sandy soils prevent the use of “low profile baskets”, baskets that support the entire root ball, including the top, are allowable.
    b. Twine and burlap used for wrapping the root ball package shall be natural, biodegradable material. If the burlap decomposes after digging the tree then the root ball shall be rewrapped prior to shipping if roots have not yet grown to keep root ball intact during shipping.

G. Container Plants
1. Container plants may be permitted only when indicated on the drawing, in this specification, or approved by the Owner’s Representative.
2. Provide plants shall be established and well rooted in removable containers.
3. Container class size shall conform to ANSI Z60.1 for container plants for each size and type of plant.

2.3 TREE STABILIZATION MATERIALS

A. Root ball stabilization system. For Trees larger than 4” in caliper use the following stabilization materials and details as indicated in the drawings”

1. Upright and Guy Stakes: Rough-sawn, sound, new hardwood free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal (38-by-38-mm actual) by length indicated, pointed at one end.
2. Wood Deadmen: Timbers measuring 8 inches (200 mm) in diameter and 48 inches (1200 mm) long, treated with specified wood pressure-preservative treatment.
3. Flexible Ties: Wide rubber or elastic bands or straps of length required to reach stakes.
4. Tree-Tie Webbing: UV-resistant polypropylene or nylon webbing with brass grommets.

2.4 MULCH MATERIALS

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A. Organic Wood Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
   1. Organic Wood Mulch shall be double-shredded well-composted, hardwood bark, aged nine (9) months to one (1) year. Particle size shall be two inches (2") or less in any dimension with less than thirty percent (30%) comprised of fines. Mulch shall be free of wood chips, stones or other undesirable matter. Mulch shall be natural color.
   2. Post-consumer materials, such as pallets, and dyes shall not be permitted.

2.5 PLANTING GUARD

A. Earth Anchor with Augers:

   1. 1. 25" L ½" thick steel anchor, with 3"-4" diameter auger

B. Vinyl-coated metal cable with metal clamps.

PART 3 EXECUTION

3.1 EXAMINATION OF SITE

A. Prior to excavation of planting areas, ascertain the location of all electric cables, conduits, underdrainage systems and utility lines. Take proper precautions so as not to disturb or damage sub-surface elements. If sub-surface elements are uncovered, promptly notify the Landscape Architect, who will relocate the plants. If Contractor fails to follow this procedure he is responsible for making requisite repairs to damaged utilities at his own expense.

   1. Verify that required underground utilities are available, in proper location and ready for use. Coordinate with other trades.
   2. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.

B. Examine the surface grades and soil conditions to confirm that the requirements of Section 329100 "Planting Soil" - and on the Planting Soil Plan and Details have been completed. Notify the Landscape Architect in writing of any unsatisfactory conditions.

3.2 PREPARATION

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A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.
B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
C. Coordinate with Section 321600 – “Metal Edging.”

3.3 PROTECTION DURING CONSTRUCTION

A. The Contractor shall protect planting and related work and other site work from damage due to planting operations, operations by other Contractors or trespassers. Maintain protection during installation until Substantial Completion Acceptance. Treat, repair or replace damaged work immediately.
B. Damage done by the Contractor, or any of their sub-contractors to existing or installed plants, or any other parts of the work or existing features to remain, including roots, trunk or branches of large existing trees, soil, paving, utilities, lighting, irrigation, other finished work and surfaces including those on adjacent property, shall be cleaned, repaired or replaced by the Contractor at no expense to the Owner. The Landscape Architect shall determine when such cleaning, replacement or repair is satisfactory.

3.4 SOIL PROTECTION DURING PLANT DELIVERY AND INSTALLATION

A. Protect soil from compaction during the delivery of plants to the planting locations, digging of planting holes and installing plants.

    1. Where possible deliver and plant trees that will require the use of heavy mechanized equipment prior to final soil preparation. Where possible, restrict the driving lanes to one area instead of driving over and compacting a large area of soil.

3.5 LAYOUT AND SEQUENCE

A. Relative positions of all plants and trees are subject to approval of the Landscape Architect.
B. Notify the Landscape Architect, one (1) week prior to layout. Layout all individual tree and shrub locations. Place plants above surface at planting location or place a labeled stake at planting location. Layout bed lines with paint for the Landscape Architect’s approval. Secure the Landscape Architect’s acceptance before digging and start of planting work.
C. When applicable, plant trees before other plants are installed.
D. It is understood that plants are not precise objects and that minor adjustments in the layout will be required as the planting plan is constructed. These adjustments may not be apparent until some or all of the plants are installed. Make adjustments as required by the Landscape Architect including relocating previously installed plants.

3.6 INSTALLATION OF PLANTS, GENERAL

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A. Installation plan shall be submitted a minimum of 14 days prior to the scheduled installation. Plan should describe the methods, activities, materials and schedule to achieve installation of plants.
B. Observe each plant after delivery and prior to installation for damage of other characteristics that may cause rejection of the plant. Notify the Landscape Architect of any condition observed. The root system of each plant, shall be observed by the Contractor, at the time of planting to confirm that the roots meet the requirements for plant root quality in Part 2 Products: Plants, General.
C. No more plants shall be distributed in planting area than can be planted and watered on the same day.
D. For trees to be planted in prepared Planting Soil that is deeper than the root ball depth, compact the soil under the root ball using a mechanical tamper to assure a firm bedding for the root ball.
E. The measuring point for root ball depth shall be the average height of the outer edge of the root ball after any required root ball modification. The tree graft, if applicable, shall be visible above the grade. Do not place soil on top of the root ball.
F. The Landscape Architect may request that plants orientation be rotated when planted based on the form of the plant.
G. Brace root ball by tamping Planting Soil around the lower portion of the root ball. Place additional Planting Soil around base and sides of ball in six-inch (6") lifts. Lightly tamp each lift using foot pressure or hand tools to settle backfill, support the tree and eliminate voids.
H. Thoroughly water the Planting Soil and root ball immediately after planting.
I. Remove all nursery plant identification tags and ribbons as per Landscape Architect instructions. The Landscape Architect’s seals are to remain on plants until the end of the final acceptance.
J. Balled and Burlapped Plants

    1. After the root ball has been backfilled, remove all twine and burlap from the top of the root ball. Cut the burlap away; do not fold down onto the Planting Soil.
    2. If the plant is shipped with a wire basket that does not meet the requirements of a “Low Rise” basket, remove the top 6 - 8 inches of the basket wires just before the final backfilling of the tree.
    3. Earth root balls shall be kept intact except for any modifications required by the Landscape Architect.

K. Container Plants

    1. Remove the container. Inspect roots, detangle and/or cut any girdling roots, loosen roots at edge of root ball.
    2. Plants shall be planted at the intervals called out for on the drawings, unless otherwise noted. The first row of plants shall be 6 inches from the bed edge unless otherwise directed.

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3. Dig planting holes sufficiently large enough to insert the root system without deforming the roots. Set the top of the root system at the grade of the soil. Press soil to bring the root system in contact with the soil.
4. Schedule the planting to occur prior to application of the mulch. If the bed is already mulched, pull the mulch from around the hole and plant into the soil. Do not plant the root system in the mulch.
5. Apply mulch to the bed being sure not to cover the tops of the plants with or the tops of the root ball with mulch.
6. Water each planting area as soon as the planting is completed. Apply additional water to keep the soil moisture at the required levels. Do not over water.

L. Obstructions Below Ground

1. In the event that rock, underground construction work, utilities or obstructions are encountered in any plant pit excavation work under this Contract, alternate locations may be selected by the Landscape Architect.
2. Where locations cannot be changed, the obstruction shall be removed, subject to the Landscape Architect's approval, to a depth of not less than three (3) feet below grade and no less than six (6) inches below bottom of ball or roots when plant is properly set at the required grade. Payment shall be made in accordance with the Contract.

M. Set and support bare-root stock in center of planting pit or trench with root flare 1 inch (25 mm) above adjacent finish grade.

1. Use planting soil for backfill.
2. Spread roots without tangling or turning toward surface, and carefully work backfill around roots by hand. Puddle with water until backfill layers are completely saturated. Plumb before backfilling, and maintain plumb while working backfill around roots and placing layers above roots.
3. Continue backfilling process. Water again after placing and tamping final layer of soil.

N. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

O. Installation Inspection

1. The Landscape Architect will inspect trees for injury to trunks, evidence of insect infestation and improper pruning before wrapping. Treat injuries of infestation by accepted methods. Remove and replace plants determined by the Landscape Architect to have injuries or infestations which cannot be treated or which have

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caused unacceptable damage to the plant.

3.7 TREE STABILIZATION, STAKING AND GUYING

A. As indicated in drawings.
B. Install above grade staking or guying for trees only as specifically indicated for trees larger than 4” in caliper.
C. Trees shall stand plumb after installation of root ball stabilization system or staking and guying.

3.8 STRAIGHTENING PLANTS

A. Maintain all plants in a plumb position. Straighten all trees that move out of plumb including those not staked. Plants to be straightened shall be excavated and the root ball moved to a plumb position, and then re-backfilled.
B. Do not straighten plants by pulling the trunk.

3.9 PLANTING BED FINISHING

A. After planting, smooth out all grades between plants before mulching.
B. Separate the edges of planting beds and lawn areas with a smooth, formed edge cut into the turf with the bed mulch level slightly lower, 1 to 2 inches, than the adjacent turf sod or as directed by the Landscape Architect. Bed edge lines shall be as depicted on the drawings.

3.10 INSTALLATION OF PLANTING GUARDS

A. After planting, install earth anchors with augurs, at all planting bed edges.
B. Earth anchor posts spacing: 4ft O.C.

3.11 PLANTING AREA MULCHING

A. Apply 3 inches (maximum) of mulch before settlement, covering the entire planting bed area. Install no more than 1 inch of mulch over the top of the root balls of all plants. Taper to 2 inches when abutting pavement.
B. Lift all leaves, low hanging stems and other green portions of small plants out of the mulch if covered.

3.12 WATERING

A. The Contractor shall be fully responsible to ensure that adequate water is provided to all plants from the point of installation until the date of Substantial Completion Acceptance.

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The Contractor shall adjust the automatic irrigation system, if available, and apply additional or adjust for less water using hoses as required.

B. Hand water root balls of all plants to assure that the root balls have moisture above wilt point and below field capacity. Test the moisture content in each root ball and the soil outside the root ball to determine the water content.

3.13 PLANT MAINTENANCE PRIOR TO SUBSTANTIAL COMPLETION ACCEPTANCE

A. During the project work period and prior to Substantial Completion Acceptance, the Contractor shall maintain all plants.

B. Maintenance during the period prior to Substantial Completion Acceptance shall consist of all operations needed support plant health and maintain the site. This work will include but is not limited to pruning, watering, cultivating, weeding, mulching, removal of dead material, repairing and replacing of tree stakes, tightening and repairing of guys, and resetting plants to proper grades and upright position.

C. Plant replacement: Replace all plants that are dead or declining as decided by Landscape Architect, as soon as the plant decline is obvious and in suitable weather and season for planting as outlined in above sections.

3.14 SUBSTANTIAL COMPLETION ACCEPTANCE & FINAL ACCEPTANCE

A. Upon written notice from the Contractor, the Landscape Architect shall review the work and make a determination if the work is substantially complete.
   1. Notification shall be according to Division 01 requirements prior to the date the Contractor is requesting the review.
   2. Any outstanding items and/or necessary changes will be recorded, the Contractor is required to complete all punch list items in a timely manner.

B. Final Acceptance can be issued when Landscape Architect with the Contractor can establish that all provisions of the contract are complete and the work is satisfactory.

   1. If the work is satisfactory, the PLANT MAINTENANCE PRIOR TO SUBSTANTIAL COMPLETION ACCEPTANCE period will end on the date of the final observation.
   2. If the work is deemed unsatisfactory, the interim maintenance will continue at no additional expense to the Owner until the work has been completed, observed, and approved by the Landscape Architect.
   3. 2 Year PLANT MAINTENANCE begins after final acceptance of all installation work.

3.15 CLEAN UP AND DISPOSAL

A. Maintain the site in an orderly condition during the progress of Work. Continuously and promptly remove excess and waste materials; keep lawn areas, walks and roads clear. Store

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materials and equipment where directed. Immediately remove rejected materials from the property. Promptly remove equipment, surplus material, and debris and trash resulting from operations under this Contract upon completion and prior to initial acceptance of Work. Leave the site in a neat, orderly condition, "broom clean".

B. During installation, keep the site free of trash. Remove trash and debris in containers from the site no less than once a week.

1. Immediately clean up any spilled or tracked soil, fuel, oil, trash or debris deposited by the Contractor from all surfaces within the project or on public right of ways and neighboring property.

C. Once installation is complete, wash all soil from pavements and other structures. Ensure that mulch is confined to planting beds and that all tags and flagging tape are removed from the site.

D. Make all repairs to grades, ruts, and damage by the plant installer to the work or other work at the site.

E. Remove and dispose of all excess planting soil, subsoil, mulch, plants, packaging, and other material brought to the site by the Contractor.

END OF SECTION

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SECTION 33 10 00 – WATER UTILITIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes water-distribution piping and related components outside the building for water service and fire service mains.

B. Water Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.3 SUBMITTALS

A. Submit for approval of shop drawings for all materials proposed to be furnished prior to the ordering or manufacture of the materials. The submittals shall contain all pertinent design information required to determine compliance with the specifications given herein

B. Submit the following test data: Pipe leakage test sheets.

1.4 QUALITY ASSURANCE

A. Owner shall, at all times, have access to all places of manufacture where materials are being fabricated or tested, and shall be at liberty at all times to inspect all materials and observe all tests on the materials. Any materials which, in the opinion of Owner, are not in conformity with the specifications herein stated, or the drawings submitted as herein required, will be rejected and removed from the site immediately.

B. Unless otherwise specified herein, materials shall be manufactured, tested and inspected by the manufacturer in the manner required by the latest revision of ASTM and AWWA/ANSI specifications. Such tests shall be at Contractor's expense. Contractor shall furnish to Owner two certified copies of the results of all materials tests and inspections. Should Owner not be present for the tests, Contractor shall furnish a sworn statement that the inspections and tests have been made in accordance with AWWA/ANSI standards. Materials will not be accepted until test results are accepted by Owner.

C. Owner may choose to make spot tests for which the manufacturer shall submit samples at no cost to Owner. Certification forms shall include project name, location, Contractor and test lot number. Lot sizes shall be acceptable to Owner.

D. Ductile Iron Pipe Epoxy Lining: The lining shall be applied by a certified firm with a successful history of applying linings to the interior of ductile iron pipe and fittings. All applicators must

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be independently inspected at least two times per year to ensure compliance with the requirements of this Specification. This inspection must be coordinated and reviewed by the manufacturer of the lining material and any deviation from the application and/or quality requirements shall be corrected by the applicator. All inspections shall be in writing and a permanent record maintained.

1.5 MATERIAL

A. All materials must be delivered in all respects sound and in conformance with these Specifications. The inspection shall not relieve Contractor of any of his/her obligations specified herein, and any material found to be defective which may have been accepted by Owner at the foundry or elsewhere shall be at all times liable to rejection until installed, tested and accepted.

B. Care shall be taken not to injure the coating or lining of pipe or other materials during handling and transportation of the materials. Lined pipe and fittings must be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc. shall be placed inside the pipe and fittings for lifting, positioning, or laying. The pipe shall not be dropped or unloaded by rolling.

C. Care should be taken not to let pipe strike sharp objects while swinging or being off loaded.

D. Ductile iron pipe should never be placed on grade by use of hydraulic pressure from an excavator bucket or by banging with heavy hammers.

1.6 DELIVERY, STORAGE AND PROTECTION

A. Pipe shall be stored at the job site in such a manner as to protect the pipe from damage. Non-rigid pipe must be stored to prevent bowing. Pipes having deviations from straight greater than 1/16 inch per foot of length shall not be used. Pipe, fittings and specials with visible breakage or other defects shall not be used, or repaired and used, unless specifically accepted by Owner in writing. Pipe shall be kept clean at all times.

B. Plastic pipe shall be kept covered to prevent exposure from ultra-violet exposure of sun.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Sanitary Sewer Pipe:

1. Ductile Iron Pipe

a. American Cast Iron Pipe Company
b. Clow Water Systems Company,
c. United States Pipe and Foundry Company,
d. Or Accepted Equal.

2. Reinforced Concrete Pipe

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a. Hanson Pipe and Precast,
b. Independent Concrete Pipe Company,
c. Or Accepted Equal.

3. Vitrified Clay Pipe

a. The Logan Clay Product Company,
b. Superior Clay Corporation,
c. Or Accepted Equal.

4. Centrifugally Cast Fiberglass Reinforced Polymer Mortar (CCFRPM) Pipe or Fiberglass Fiber Reinforced Polymer Pipe

a. Hobas USA, Houston, Texas,
b. Flowtite USA, Rialto, California
c. Or Accepted Equal.

5. Polyvinyl Chloride (PVC) Composite Pipe

a. Contech Engineered Solutions, LLC,
b. Or Accepted Equal.

B. Precast Concrete Manhole Structures

1. Mack Industries, Inc.
2. Independent Concrete Pipe Company,
3. Lindsay Precast Inc.,
4. Or Accepted Equal.

C. Manhole Frames and Covers

1. Neenah Foundry Inc., R-1642,
2. East Jordan Iron Works Inc., 1046Z or 1048Z frames with 1040A lid,
3. Or Accepted Equal.

D. Manhole Steps

1. M.A. Industries, Inc., PS1-PF-DF 004-501-DF,
2. Or Accepted Equal.

2.2 GRAVITY SANITARY SEWER PIPE

A. Ductile Iron Pipe and Joints:

1. All ductile iron pipe shall be centrifugally cast Class 53 minimum or as identified on Contract Drawings.
2. Ductile iron fittings shall conform with AWWA C110/A21.10 or C153/A21.53AWWA C111/ANSI 21.11.
3. Material used for ductile iron pipe shall conform with ASTM A746.
4. Lining:
   a. The pipe, fittings, and joints shall be lined with Protecto 401 TM Ceramic Epoxy or Accepted Equal. The material shall be an amine cured novolac epoxy containing at least 20 percent by volume of ceramic quartz pigment.

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b. All pipe, fittings, and joints shall be delivered to the epoxy lining application facility without asphalt, cement lining, or any other lining on the interior surface. The entire interior of the pipe, fittings, and joints shall not have been lined with any substance prior to the application of the specified lining material and no coating shall have been applied to the first six inches of the exterior of the spigot ends.
c. A permeability rating of 0.00 when tested according to Method A of ASTM E96, Procedure A with a test duration of 30 days.
d. The following tests must be run on coupons from factory lined ductile iron pipe:

    1) ASTM B-117: Results to equal 0.00 undercutting after two years.
    2) ASTM G-95: 1.5 volts @ 77 degrees F. Results to equal no more than 0.5-mm undercutting after 30 days.
    3) Immersion testing rated using ASTM D-714-87.

        (a) 20 percent sulfuric acid: No effect after two years.
        (b) 140 degrees F 25 percent Sodium Hydroxide: No effect after two years.
        (c) 160 degrees F distilled water: No effect after two years.
        (d) 120 degrees F tap water (scribed panel): 0.0 undercutting after two years with no effect.

    4) ASTM G-22: Standard practice for determining resistance of synthetic polymeric materials to bacteria. The test should determine the resistance to growth of acidithiobacillus bacteria and should be conducted at 30 degrees C for a period of seven days on a minimum of four panels. The growth must be limited only to trace amounts of bacteria.

e. An abrasion resistance of no more than three-mils (0.075 mm) loss after one million cycles using European Standard EN 598: 1994 Section 7.8 Abrasion Resistance.
f. All ductile iron pipe and fitting linings shall be checked for thickness using a magnetic film thickness gauge. The thickness testing shall be done using the method outlined in SSPC PA-2 Film Thickness Rating.
g. The interior lining of all pipe barrels and fittings shall be tested for pinholes with a non-destructive 2,500 volt test. Any defects found shall be repaired prior to shipment.
h. Each pipe joint and fitting shall be marked with the date of application of the lining system along with its numerical sequence of application on that date and records maintained by the applicator of his work.

5. All pipe shall be furnished in 18- or 20-foot laying lengths, plus or minus one inch. No cut off pipe will be accepted.
6. Each pipe shall be subjected to a hydrostatic test pressure in accordance with ASTM A746.
7. Every pipe shall be marked in accordance with ASTM A746.
8. Joints:

    a. Bell and spigot push-on joints, complete with gaskets and lubricants. Gaskets and lubricant for all joints furnished under these specifications shall be manufactured in accordance with ANSI A 21.11 (AWWA C 111).
    b. When restrained joint pipe is specified on the construction drawings, the restrained joint shall be completely boltless (essentially boltless for greater than 36-inch size) and shall be rated at a working pressure up to 350 psi (up to 24-inch size) or 250 psi

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(greater than 24-inch size). The joint shall be capable of being deflected three degrees after assembly, with uniform load distribution between the restraining components when the joint is deflected.

c. The joint shall have a ductile iron lock ring welded to the plain end with a 360-degree continuous weld. All welds on field-cut pipe shall be made inside a shop by a certified welder. The joint shall be capable of being easily disassembled should the need arise. The joint shall meet all push-on joint requirements of the latest revision of ANSI A21.11 (AWWA C111).

B. Vitrified Clay Pipe and Joints

1. All pipes shall meet ASTM C700 requirements, extra strength.
2. Resilient and flexible joints shall meet ASTM C425 requirements.

C. Reinforced Concrete Pipe and Joints

1. All pipes shall meet ASTM C76 requirements.
2. All reinforced concrete pipe shall be manufactured using Type II Cement.
3. Marking: After the capital letter "D" designating the D-load, the design wall thickness in inches shall be expressed as a decimal. Pipe with "S" stirrups shall have the symbol S. Pipe requiring axis orientation without lift holes (i.e., stirrup pipe, quadrant reinforced pipe, elliptically reinforced pipe) shall have the center line of the crown of the pipe marked inside and outside with the symbol TB. Pipe with quadrant steel shall be marked with the symbol Q. Pipe with elliptical reinforcement shall be marked with the symbol E. Pipe with deformed wire reinforcement required in the design shall have the symbol DF.
4. Resilient and flexible gasket joints shall meet ASTM C443 requirements.
5. Resilient connectors between reinforced concrete manhole structures and pipes shall meet ASTM C923 requirements.
6. Flexible Plastic Gasket: For concrete pipe, AASHTO M198, Type B, with the following exception:

    a. Flash point and fire point are waived.

D. Centrifugally Cast Fiberglass Reinforced Polymer Mortar Pipe (CCFRPMP) or Fiberglass Reinforced Polymer Mortar Pipe (FRPMP) and Joints (Note Where plans and specifications refer to CCFRPMP, either type is allowed):

1. Design, manufacture, and testing in accordance with ASTM D3262. Open cut portions of sewer pipe shall have a stiffness class which will satisfy all design requirements, but in no case be less than pipe stiffness of 72 psi when tested in accordance with ASTM D2412. Sewer pipe that is to be performed by pipe jacking shall have a factor of safety of 2.5 and an allowable safe jacking load of no less than 700 tons or per manufacturers recommendations.
2. Manufacture pipe by a centrifugal casting or filament process with computer-controlled material placement such that resultant product has a dense, nonporous, corrosive-resistant consistent composite structure.
3. The internal liner shall be suitable for service in a sewer pipe, and shall be highly resistant to exposure to sulfuric acid as produced by biological activity from hydrogen sulfide gases. Pipe shall meet or exceed requirements of ASTM D3681.

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4. Pipe shall be supplied in nominal lengths of 20 - 25 feet. Actual lay length shall be nominal ±1 inch. Special short lengths may be used where surface geography or installation conditions require shorter lengths.
5. Wall thickness measured at the bottom of the spigot gasket groove shall be determined by the maximum load anticipated under all installation conditions. The average wall thickness of the pipe shall not be less than the nominal wall thickness published in the manufacturer's literature, and the minimum wall thickness at any point shall not be less than 87.5% of the nominal wall thickness.
6. Pipe ends shall be true and square to the pipe axis with a maximum tolerance of 1/8 inch.
7. Resin shall be a polyester resin system suitable for the service conditions.
8. Glass reinforcing fibers shall be of commercial grade E-glass filaments with binder and sizing compatible with the impregnating resin system.
9. Silica sand shall be a minimum of 98 percent by weight silica, with moisture content less than or equal to 0.2 percent.
10. Additives shall be of a proven result and of a nature which shall not degrade the finished product performance. Resin additives, such as curing agents, pigments, dyes, fillers, thixotrophic agents, etc., when used, shall not detrimentally effect the performance of the product.
11. Joints:
    a. Pipes shall be a filament wound composite (FWC) coupling configuration utilizing an elastomeric sealing gasket.
    b. Elastomeric sealing gaskets shall be suitable for the intended service and shall be produced and supplied by a manufacturer typically engaged in the manufacture of such materials conforming to ASTM F477.
    c. Joints shall meet the performance requirements of ASTM D4161.
12. Fittings, Miters, and Specials:
    a. Changes in pipe alignment not located at manholes shall be made with manufactured miters or fittings or use of short pipe sections.
    b. Any pipe fittings, miters, and specials shall be provided by the pipe manufacturer, as shown on the drawings and/or as required by the service conditions (including connection to existing piping).
13. Connections:
    a. The pipe shall be field connected with glass reinforced plastic sleeve couplings that utilize elastomeric sealing gaskets as the sole means to maintain joint water tightness. The joints shall utilize elastomeric sealing gaskets meeting the performance requirements of ASTM D4161.
    b. Connections made to existing service laterals, side sewers, or manholes from within the pipe shall be made in accordance with the Contract Drawings and manufacturer's recommendations.
14. Connection or closure details for the aforementioned conditions shall be submitted to CMT for review and approval. Connection or closure details shall be in accordance with industry standards, and material manufacture specifications.

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15. Pipe and joints used for direct jack installation shall be manufactured to support all additional loading conditions as specified elsewhere.

E. PVC Composite Pipe and Joints

1. Pipe and fittings shall conform to ASTM D2680, with the following additions and exceptions:

    a. Joints shall be gasketed conforming to ASTM D3212, using elastomeric gaskets conforming to ASTM F477. Use only lubricant supplied or recommended for use by the pipe manufacturer. Verify that the ends of the pipe are marked to indicate insertion stop (home) position, and ensure that pipe is inserted into pipe or fitting bells to this mark. Protect the end of the pipe during homing and do not use excessive force that may result in over-assembled joints or dislodged gaskets. If full insertion is not achieved, disassemble and clean the joint and reassemble. All pipe ends shall be properly sealed prior to joining the pipe using a material recommended by the pipe manufacturer.
    b. Factory made fittings must be used on all house connections or other connections. Bedding material for house connections (sanitary sewer house laterals) shall be equal to that of the main sewer. Risers in deep or unstable trenches should be embedded in Class I materials only. Brackets or anchors shall be used to hold end caps or plugs in place on sanitary sewers for the purpose of withstanding air test pressures. Caps or plugs shall not be chemically welded in place.
    c. All pipe and fittings shall be suitably marked to provide manufacturer's name, lot or production number, ASTM designation, ABS, nominal diameter and SDR number. Fittings need not contain the lot or production number. Pipe shall have a "home" mark. Composite pipe with an absence of filler material at the ends greater than¼-inch deep shall be subject to rejection or must be repaired, if required, to an acceptable condition.

F. PVC Pipe and Joints

1. Pipe and fittings shall conform to ASTM F679 for 18-inch to 48-inch pipe.
2. Pipe and fittings shall conform to ASTM D3034 for four-inch to 15-inch pipe, with the following additions and exceptions:

    a. All pipe and fittings for sanitary sewers shall conform to SDR 26 for mainline and SDR 23.5 for laterals.

3. All joints shall be of the elastomeric gasket type, and shall be assembled per manufacturer’s recommendations and ASTM D3212. Care shall be taken to ensure all joints are being pushed to the full "home" position and held tightly in the "home" position during any grade or line adjustments.
4. Factory made fittings must be used on all house connections or other connections. Bedding material for house connections (sanitary sewer house laterals) shall be equal to that of the main sewer. Risers in deep or unstable trenches shall be embedded in Class I materials only. Brackets or anchors shall be used to hold end caps or plugs in place on sanitary sewers and house laterals for the purpose of withstanding air testing pressures. Caps or plugs shall not be chemically welded in place.

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5. All pipe and fittings shall be suitably marked to provide manufacturer's name or trademark, lot or production number, ASTM designation, PVC cell classification, SDR number (if applicable) and nominal diameter. Fittings need not contain a lot number, cell classification or SDR number (if applicable). Pipe shall have a "home" mark.

2.3 PRECAST CONCRETE MANHOLES

A. All manholes on sanitary sewers shall be precast reinforced concrete risers with cast-in-place concrete base slabs.

B. All precast reinforced concrete manholes shall be manufactured using Type II cement.

C. Precast concrete manholes on sanitary and combination sewers shall be epoxycoated as indicated on the Contract Drawings and shall be installed with a full depth channel constructed of precast concrete (using Type II cement), pour in place concrete (using Type II cement), or vitrified brick with mortar joints not more than ¼-inch wide. Slab top manholes shall be as indicated on the Contract Drawings.

D. Precast reinforced concrete manhole riser sections: ASTM C 478.

1. Joints. ASTM C 443.
2. Compression Tests. Compression tests for satisfying the minimum specified concrete strength requirements shall be made from cores not less than 3½ inches in diameter drilled from the wall of the risers, cones or tops. Cores shall be obtained, prepared for testing, and tested by the appropriate methods of AASHTO T 33.

E. Contractor shall construct manholes complete, in accordance with the Contract Drawings, including castings, covers, slab tops, steps, plastering, pointing, interior coating, joint sealing and all incidentals. The inlet and outlet treatment of pipe at manholes shall be in accordance with the Contract Drawings and shall be included in the price bid per linear feet of the appropriate pipe item. Pipe, fittings, concrete or masonry required for drop connections shall be included in the price bid for drop manholes complete. Sanitary manhole types shall be as designated on the Contract Drawings.

2.4 MANHOLE FRAME AND COVERS

A. Frames, covers, and related appurtenances shall meet AASHTO M-306.

B. Bearing parts of frames and covers shall be machined to provide a firm and even seat for any position of the cover.

C. Frames and covers shall not vary more than 1/16 inch per foot in any dimension or more than 5 percent in weight from those called for by the manufacturer and be free of all defects.

D. Frames and covers shall be marked to show the manufacturer’s name, part number, and cast date in cast-on letters/numbers.

E. Step treads shall have sharp well defined checks and all corners shall be round.

F. Manhole steps for precast manholes shall conform with ASTM C478 and shall be polypropylene. Propylene plastic shall conform to ASTM D 4104. The manufacturer shall furnish certified test data for the propylene plastic used in each lot of steps.

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G. Solid manhole covers shall be used for sanitary sewers.

H. Identify covers with cast marking as “CITY OF AKRON, SEWER.”

I. Provide casting free of blowholes, splits, cracks, blisters, mold-pull, and other imperfections affecting strength or serviceability.

J. The manhole frame shall be set in a full bed of mortar and, if appropriate, adjusted to conform to the surface of the roadway. Care shall be taken with setting and adjusting the frame in order to maintain a full and firm bearing on the mortar bed.

K. When directed by CMT or noted on the Contract Drawings, manholes shall have locking covers.

2.5 BEDDING AND COVER MATERIALS

A. Bedding shall be compacted to not less than 95% of the maximum dry density at +/-2% of optimum moisture content.

2.6 APPURTENANCES

A. Provide all necessary appurtenances for a full and complete piping system suitable for operation, and in conformance with Contract Documents

2.7 SHOP PAINTING COATINGS

A. For Ductile Iron Pipes:

1. All pipe shall have an asphaltic-based seal coat applied to the exterior surface.

B. For Reinforced Concrete Pipes:

1. The interior barrel and joint surface areas of the concrete pipe for sanitary sewers shall be prepared as per manufacturer's recommendations so as to remove all forms of oil, laitance and other deleterious materials. Concrete must be etched with a 15 to 20 percent muriatic acid solution or brush blasted to achieve a medium grade profile. The surface so prepared shall then be lined with a high build, polyamide-cured, two-component coal tar epoxy coating "Bitumastic No. 300-M" as manufactured by Koppers Company, Inc., Pittsburgh, Pennsylvania 15219, or an Accepted Equal, each meeting military Specification DOD-P-23236A (SH), Type 1, Class 2.
2. The lining compound shall be sprayed two or more coats with a minimum of ten to 12 dry mils (12 to 14 wet mils) per coat to obtain a continuous and relatively uniform and smooth lining.
3. The total dry film thickness should not be less than 20 mils (0.02 inches).
4. Additional coatings may be necessary for pipes to be laid on steep grades or within industrial areas, as shown on the Contract Drawings.
5. All coated pipe shall be free of surface irregularities such as air bubbles, delaminations, lumping, sagging, blistering, pinholes or porosity in the coating film.

2.8 SHOP TESTING

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A. Test all pipes per manufacturer requirements, and as required by pertinent standards.

PART 3 EXECUTION

3.1 EXAMINATION

A. For reinforced concrete pipe:

1. Acceptance: Concrete pipe may be judged for acceptance on the basis of cores cut from the pipe wall.
2. Visual Inspection: The core shall be examined for reinforcing steel area and spacing, steel position as to cover depth, lack of bond between cement paste and reinforcing steel, and void around the reinforcing steel.
3. Void Inspection: If voids are found larger than one-quarter of the diameter of the reinforcing steel and extending along the steel throughout the core diameter, the pipe will be subject to retest. If the same condition is found in the retest pipe, the pipe will be rejected.
4. Test Specimens: The pipe to be cored will be the same as tested for three edge bearing test and the retest pipe will be two for one the same as ASTM C 76.

3.2 PREPARATION

A. Sanitary sewer pipe

1. For all rigid pipe installations, the width of the trench at the top of the pipe shall not exceed the outside pipe diameter, including bells, plus the clear width on each side of the pipe as listed in Table 33 30 00-1:
2. For all non-rigid pipe installations, the minimum trench width shall be per the pipe manufacturer's recommendations, but at no time shall the width be less than that specified in ASTM D2321.
3. The length of trench or tunnel open at any one time shall conform to the limits accepted by Owner. In general, not more than 100 feet of trench shall be opened in advance of the completed work.
4. Where the sewer pipes are built upon the surface of the ground, the surface shall be grubbed and cleared of all stumps, grass, muck, or other vegetable matter.
5. Pipes shall not be constructed on frozen ground.

Table 03 33 00-1

Pipe Size (in)	Maximum Clear Width (in)
6 – 24	12
27 – 54	15
60 and over	24

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3.3 SANITARY SEWER PIPE INSTALLATION

A. Pipe shall be laid accurately to the line and grade designated on the Contract Drawings. Pipe shall be carefully centered so that when laid it will form a sewer with close fitting joints.

B. All pipe shall begin and end with pipe ends as normally fabricated by the manufacturers. If field cutting pipe is required, cutting shall be performed by the use of tools or equipment that will provide a neat perpendicular cut with a beveled end without structural damage to the pipe wall or damage to coatings or fillers.

C. For Ductile Iron pipes:

1. Installation of ductile iron pipes shall conform to AWWA C600 unless otherwise noted on Contract Documents.
2. Remove and replace defective pieces.
3. Clear of all debris and dirt before installing and keep clean until accepted.
4. For push-on joints, clean bell of excess tar or other obstruction and wipe out before inserting next pipe spigot. Shove pipe into place until properly seated and hold securely until joint completed.
5. Temporary Plugs: When pipe laying not in progress, close open ends of pipe with temporary watertight plugs. If water in trench, do not remove plug until danger of water entering pipe passed.
6. Appurtenances: Set fittings and appurtenances as indicated on Contract Drawings.
7. Polyethylene wrapping: All buried ductile iron piping shall be polyethylene wrapped in accordance with pipe manufacturer’s written instruction.

D. For Reinforced Concrete pipes:

1. Installation of reinforced concrete pipe shall conform to ASTM C1479 unless otherwise noted in Contract Documents.
2. Reinforced concrete pipe with auxiliary supports shall be handled and placed with the centerline of the auxiliary support system in a vertical plane.
3. Care shall be taken with all precut holes, fittings, specials, etc. to ensure that they are placed at the location and elevation indicated on the Contract Drawings.
4. It is intended that curves in 30-inch or larger diameter reinforced concrete pipe sewers be truly circular. This work shall be monolithic construction of concrete unless otherwise specified on the Contract Drawings. The use of radius pipe or cut curves may be permitted where the alignment shown on the Contract Drawings can be maintained, and a shop drawing of the cut curves or radius pipe illustrating the layout and geometry is accepted by Owner.
5. Where bracing plates or a trench box is used for the installation of pipe, all voids caused by the withdrawal of the bracing plates or the trench box shall be completely filled.
6. All lifting holes in reinforced concrete circular pipe shall be grouted with cement mortar or other approved material after the pipe has been placed.

E. For CCFRPM pipes:

1. Installation of CCFRPM pipe shall conform to ASTM D3839 unless otherwise noted on Contract Documents.

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2. Remove, replace or repair pieces of pipe discovered to be defective. Repairs shall be made only if accepted by Owner.
3. Clear of all debris and dirt before installing and keep clean until accepted.
4. Pipe shall be installed in the trench as recommended by the pipe manufacturer and accepted by Owner.
5. Lay accurately to lines and grades indicated or required. Provide accurate alignment, both horizontally and vertically.
6. Install all joints and couplings in accordance with manufacturer's directions.
7. Clean ends of pipe and joint and coupling components.
8. Apply joint lubricant to the bell interior surface and the elastomeric seals. Use only lubricants approved by the pipe and gasket manufacturers.
9. Direct jack or pipe in tunnel installations shall be as specified elsewhere.

F. For PVC pipes:

1. Installation of all sizes of PVC pipe shall conform to ASTM D2321 unless otherwise noted on Contract Documents.
2. Factory made fittings must be used on all house connections or other connections. Bedding material for house connections (sanitary sewer house laterals) shall be equal to that of the main sewer. Risers in deep or unstable trenches shall be embedded in Class I materials only. Brackets or anchors shall be used to hold end caps or plugs in place on sanitary sewers and house laterals for the purpose of withstanding air testing pressures. Caps or plugs shall not be chemically-welded in place.
3. Remove and replace defective pieces.
4. Clear of all debris and dirt before installing and keep clean until accepted.

G. Joining pipes

1. Before joining pipe with a coupling or bell end, all surfaces of the portions of the pipe to be joined and all surfaces of factory made jointing materials shall be clean and dry. Lubricants, primers, adhesives, solvents, bolts, etc. shall have been manufactured specifically for their intended use and shall be used as recommended by the pipe and/or pipe joint manufacturer. The jointing materials shall be fitted and adjusted or applied in such a manner as to obtain a close fitting joint and to obtain the degree of water tightness required.
2. Where the joining of pipes of different materials is required or approved, this work shall be done utilizing special adapters and couplers manufactured specifically for this purpose. The adapters and couplers shall be installed and securely attached to both pipe barrels according to manufacturers' recommendations.
3. As soon as possible after a joint is made, sufficient backfill materials shall be placed along each side of the pipe to support the pipe in its final position.
4. Where a pipe stub or run of pipe is to be temporarily terminated for future extension, the end of the pipe shall be sealed using an approved removable plug.

H. Where required by the Contract Drawings, flexible pipe shall be elongated by increasing its vertical diameter by five percent. The vertical elongation shall be maintained by horizontal wire struts that shall be left in place until the embankment is completed.

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3.4 PRECAST CONCRETE MANHOLE INSTALLATION

A. Contractor shall submit the following:

1. Manufacturer's name and address
2. Detailed shop drawings
3. Material specifications

B. Approval will be based on complete inspection of manufacturer's plant, method of manufacture, samples of materials to be used and inspection and testing of actual units to be used.

C. The manhole bottom shall have a uniform bearing on a minimum of three inches of compacted #57 stone. Unsuitable material shall be removed and replaced.

D. Adequate precautions shall be taken to prevent concrete and/or mortar from freezing. Any material incorporated in these items having a temperature of 40 degrees F or less shall not be placed until heated for a period sufficient to ensure a temperature of 50 degrees F to80 degrees F throughout the entire mass of the material. Refer to Section 03 30 00 Cast-in-Place Concrete for additional requirements.

E. Standard manhole steps shall be set in the cones of precast manholes as indicated on the Contract Drawings. Where the ordinance grade is below the grade of an unimproved street, the last precast section shall be built to correspond with the ordinance grade, and the manhole casting and cover set to existing grade by use of a brick chimney and/or grade rings. The inside diameter of the precast section shall be not less than 26 inches nor more than 28 inches.

F. All manholes shall be thoroughly bonded or securely connected to the barrel of the sewer, and all connections with pipes neatly made without projections or voids. Unless otherwise noted on the Contract Drawings, all pipe connected to precast concrete manholes shall be sealed by use of a resilient manhole connector meeting the requirements of ASTM C923.

G. When manholes are completed, they shall be cleared of scaffolding, centering or forms and cleaned of surplus mortar or other foreign materials.

H. Manholes on sanitary sewers shall be tested by Contractor. Testing shall be performed in accordance with ASTM C1244.

3.5 REPAIR RESTORATION

A. All surfaces affected by the construction work shall be permanently restored.

B. Before Final Completion, CONTRACTOR shall clean up the Work area.

3.6 FIELD TESTING

A. General:

1. Remove all dirt, dust, oil, grease and other foreign material before initiating testing and acceptance procedures.
2. Perform leakage tests and measurements according to applicable standards.

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B. Low Pressure Air Test:

1. All sewers, manholes or other structures and appurtenances which are to be used for sanitary sewage shall at all times be water tight and not permit the infiltration of water into, or the exfiltration of sewage therefrom. All such sewers shall be subject to an air leakage test to be performed by CONTRACTOR, under the direct observation of CMT, unless otherwise noted No request by CONTRACTOR for waiver of the test will be considered. The cost of all air-leakage testing shall be included in the unit price bid for the pipe.
2. The air test shall be performed within a reasonable time after completion of the sewer, or sections of a large portion of the sewer installation, before the Substantial Completion. CONTRACTOR shall verify that the sewers, manholes, etc. are substantially complete and reasonably clean prior to performing the test.
3. The testing procedure and criteria shall be in accordance with ASTM C828 (clay pipe – for pipe up to 42-inch diameter), C924 (concrete pipe and ductile iron pipe – for pipe sizes up to 24-inch diameter), or F1417 (plastic pipe), as applicable, and Table 33 30 00-2 which shows the minimum test time in minutes per 100 feet of pipe for each nominal pipe size for a 1.0 psi pressure drop from 3.5 to 2.5 psi. Testing procedures and criteria for PVC pipe shall be in accordance with ASTM D3212. All sanitary sewer manholes shall be tested in accordance with ASTM C1244.
4. If the sewer fails to meet the minimum test times shown in Table 33 30 00-2, Owner may order CONTRACTOR to expose and repair as required joints or any section in the test, backfill, and restore the surface. Such additional work shall be at CONTRACTOR's expense. Following the repairs, the sewer shall be retested until the minimum test time is equaled or exceeded.
5. In the event that the pipe fails to meet the test requirements, no payment to exceed 75 percent of the price bid for the pipe items shall be made until the sewer(s) satisfactorily passes the low pressure air test. Passing an air test or making repairs and passing an air test does not release CONTRACTOR from the responsibility of repair or replacement of sewers and appurtenances during the Warranty Period.

Table 33 00-2

Nominal Pipe Size (in)	Time, T (min/100 ft)	Nominal Pipe Size (in)	Time, T (min/100 ft)
3	0.2	21	3
4	0.3	24	3.6
6	0.7	27	4.2
8	1.2	30	4.8
10	1.5	33	5.4
12	1.8	36	6
15	2.1	39	6.6
18	2.4	42	7.3

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C. Individual Joint Test

1. For CCFRPM pipe 48-inch diameter or larger, individual joint testing shall conform with ASTM C1103.
2. For reinforced concrete pipe 27-inch diameter or larger, individual joint testing shall conform with ASTM C1103.

D. Deflection Test:

1. All sewers 48-inch diameter or smaller constructed using non-rigid pipe materials shall be subject to a pipe deflection test, regardless of the pipe stiffness, to be performed by CONTRACTOR. No request by CONTRACTOR for waiver of the test will be considered.
2. The deflection test will be performed at the end of the Warranty Period before release of the retainer or bond. The test shall consist of pulling a mandrel (Go/No Go) device through the sewer by hand. No mechanical pulling devices shall be used. The mandrel shall be either the full circle or 9-arm type and conform to the dimensions noted in Table 33 30 00-3. No sewer will be accepted if the pipe deflection at any point is in excess of 5 percent of its average inside diameter as noted in Table 33 30 00-3, where T-1 equals Cell Classification 12454C and T-2 equals Cell Classification 12364C.
3. All sewers larger than 48-inch diameter constructed of non-rigid material shall be entered to conduct deflection measurements directly using extension rulers, tape measures, etc. at 10-foot increments, using the same deflection criteria used for the mandrel device.
4. All portions of sewer found to exceed this limit shall be replaced or repaired by CONTRACTOR promptly in a manner approved by the Owner. After a period of at least 60 days after backfilling the repaired area(s), the sewer shall again be tested for deflection. This procedure shall be repeated as necessary until the maximum pipe deflection is 5 percent or less. CONTRACTOR shall bear the total cost of all repairs or replacement, including surface restoration.

Table 33 30 10-3

	ASTM D-3034		ASTM D-2680		ASTM F-679	
Minimal Pipe Size (in)	Average I.D. (in)	5% Deflection Mandrel (in)	Average I.D. (in)	5% Deflection Mandrel (in)	Average I.D. (in)	5% Deflection Mandrel (in)
6	5.893	5.598				
8	7.891	7.496	7.75	7.35		
10	9.864	9.371	9.75	9.25		
12	11.737	11.15	11.75	11.16		
15	14.374	13.655	14.75	14.01		
					T-1	

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18					18.165	17.257
21					21.415	20.344
24					24.092	22.887
27					27.152	25.794
					T-2	
18					18.202	17.292
21					21.459	20.3896
24					24.142	22.935
27					27.208	25.848

E. Closed Caption Television (CCTV) Inspection:

1. All sewers, manholes, inlets and other appurtenances shall be subject to CCTV and visual inspections, to be performed by CONTRACTOR, prior to Substantial Completion of the sewer items. No request by CONTRACTOR for waiver of the inspections will be considered.
2. The CCTV inspections shall be performed after completion of the sewer items, before the Substantial Completion and release of the retainer or bond. CONTRACTOR shall verify that the sewers and manholes are substantially complete and reasonably clean prior to performing the inspection.
3. CCTV inspections shall be performed in accordance with National Association of Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP), latest edition.
4. All pipe, manholes, and appurtenances found to be defective shall be replaced or repaired by CONTRACTOR promptly. CONTRACTOR shall bear the total cost of all repairs or replacement.
5. Passing the CCTV inspection or making repairs and passing the CCTV inspection does not release CONTRACTOR from the responsibility of repair or replacement of sewers and appurtenances during the Warranty Period.
6. Submit the following information prior to Substantial Completion:
    a. Database file with inspection event and defect records in Microsoft Access (.MDB) (Granite native export database, PACP 4.2 schema-compliant database, or Accepted Equal)
    b. Video file: MPEG (.mpg) or Windows Media file (.wmv). One video file per pipe inspection
    c. Inspection report: One report in Adobe Acrobat PDF format per pipe inspection. Report should include: 1) Inspection header info (who, what, where, when) (2) Defect log (3) Photos of defects
    d. Defect photos: screen captures from the video (.jpg)

3.7 FIELD PAINTING COATINGS

A. Repair any shop painting/coatings damaged during storage or installation.

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3.8 PROTECTION

A. Protect sanitary sewers from damage throughout storage, installation, testing, and Final Completion.

END OF SECTION 33 10 00

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SECTION 33 30 00 – SANITARY SEWERAGE UTILITIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

B. ASTM International (ASTM)

1. A48: Standard Specification for Gray Iron Castings.
2. A746: Standard Specification for Ductile Iron Gravity Sewer Pipe.
3. B117: Standard Practice for Operating Salt Spray (Fog) Apparatus.
4. C76: Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
5. C425: Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
6. C443: Standard Specification for Joints Concrete Pipe and Manholes, Using Rubber Gaskets.
7. C478: Precast Reinforced Concrete Manhole Sections.
8. C564: Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
9. C700: Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated.
10. C828: Standard Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines.
11. C858: Underground Precast Concrete Utility Structures.
12. C923: Resilient Connectors Between Reinforced Concrete Manhole Structures.
13. C924: Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.
14. C1103: Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Line.
15. C1244: Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.
16. C1479: Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations.
17. D714: Standard Test Method for Evaluating Degree of Blistering of Paints.
18. D1785: Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.
19. D2241: Polyvinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series).
20. D2412: Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
21. D2321: Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
22. D2729: Standard Specification for Polyvinyl Chloride (PVC) Sewer Pipe an Fittings.
23. D3034: Standard Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.
24. D3212: Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

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25. D3262: Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.
26. D3681: Standard Test Method for Chemical Resistance of “Fiberglass Pipe in a Deflected Condition”.
27. D3839: Standard Guide for Underground Installation of “Fiberglass” (Glass-Fiber Reinforced Thermosetting-Resin) Pipe.
28. D4104: Standard Specification for Polypropylene Injection and Extrusion Materials.
29. D4161: Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals.
30. E96: Standard Test Methods for Water Vapor Transmission of Materials.
31. F477: Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
32. F679: Standard Specification for Poly(Vinyl Chloride) (PVC) Large- Diameter Plastic Gravity Sewer Pipe and Fittings.
33. F1417: Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air.
34. G22: Standard Practice for Determining Resistance of Plastics to Bacteria.
35. G95: Standard Test Method for Cathodic Disbondment Test of Pipeline Coatings (Attached Cell Method).

C. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO M198: Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Join Sealants.
2. AASHTO M306: Standard Specification for Drainage, Sewer, Utility and Related Castings.
3. AASHTO T33: Test for Fine Aggregate Angularity

D. International Standards

1. EN598: Ductile Iron Pipes, Fittings, Accessories and their Joints for Sewerage Applications – Requirements and Test Methods.

1.2 SUMMARY

A. Section Includes:

1. Provide gravity sanitary sewers to municipal sewers. Pipe listed herein is for installation by direct bury installation.
2. Section includes: Precast concrete manholes, cast-iron frames and covers, and sanitary sewer pipes.

1.3 SUBMITTALS

A. Submit for approval of shop drawings for all materials proposed to be furnished prior to the ordering or manufacture of the materials. The submittals shall contain all pertinent design information required to determine compliance with the specifications given herein

B. Submit the following test data: Pipe leakage test sheets.

1.4 QUALITY ASSURANCE

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A. Owner shall, at all times, have access to all places of manufacture where materials are being fabricated or tested, and shall be at liberty at all times to inspect all materials and observe all tests on the materials. Any materials which, in the opinion of Owner, are not in conformity with the specifications herein stated, or the drawings submitted as herein required, will be rejected and removed from the site immediately.

B. Unless otherwise specified herein, materials shall be manufactured, tested and inspected by the manufacturer in the manner required by the latest revision of ASTM and AWWA/ANSI specifications. Such tests shall be at Contractor's expense. Contractor shall furnish to Owner two certified copies of the results of all materials tests and inspections. Should Owner not be present for the tests, Contractor shall furnish a sworn statement that the inspections and tests have been made in accordance with AWWA/ANSI standards. Materials will not be accepted until test results are accepted by Owner.

C. Owner may choose to make spot tests for which the manufacturer shall submit samples at no cost to Owner. Certification forms shall include project name, location, Contractor and test lot number. Lot sizes shall be acceptable to Owner.

D. Ductile Iron Pipe Epoxy Lining: The lining shall be applied by a certified firm with a successful history of applying linings to the interior of ductile iron pipe and fittings. All applicators must be independently inspected at least two times per year to ensure compliance with the requirements of this Specification. This inspection must be coordinated and reviewed by the manufacturer of the lining material and any deviation from the application and/or quality requirements shall be corrected by the applicator. All inspections shall be in writing and a permanent record maintained.

1.5 MATERIAL

A. All materials must be delivered in all respects sound and in conformance with these Specifications. The inspection shall not relieve Contractor of any of his/her obligations specified herein, and any material found to be defective which may have been accepted by Owner at the foundry or elsewhere shall be at all times liable to rejection until installed, tested and accepted.

B. Care shall be taken not to injure the coating or lining of pipe or other materials during handling and transportation of the materials. Lined pipe and fittings must be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc. shall be placed inside the pipe and fittings for lifting, positioning, or laying. The pipe shall not be dropped or unloaded by rolling.

C. Care should be taken not to let pipe strike sharp objects while swinging or being off loaded.

D. Ductile iron pipe should never be placed on grade by use of hydraulic pressure from an excavator bucket or by banging with heavy hammers.

1.6 DELIVERY, STORAGE AND PROTECTION

A. Pipe shall be stored at the job site in such a manner as to protect the pipe from damage. Non-rigid pipe must be stored to prevent bowing. Pipes having deviations from straight greater

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than 1/16 inch per foot of length shall not be used. Pipe, fittings and specials with visible breakage or other defects shall not be used, or repaired and used, unless specifically accepted by Owner in writing. Pipe shall be kept clean at all times.

B. Plastic pipe shall be kept covered to prevent exposure from ultra-violet exposure of sun.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Sanitary Sewer Pipe:

1. Ductile Iron Pipe

    a. American Cast Iron Pipe Company
    b. Clow Water Systems Company,
    c. United States Pipe and Foundry Company,
    d. Or Accepted Equal.

2. Reinforced Concrete Pipe

    a. Hanson Pipe and Precast,
    b. Independent Concrete Pipe Company,
    c. Or Accepted Equal.

3. Vitrified Clay Pipe

    a. The Logan Clay Product Company,
    b. Superior Clay Corporation,
    c. Or Accepted Equal.

4. Centrifugally Cast Fiberglass Reinforced Polymer Mortar (CCFRPM) Pipe or Fiberglass Fiber Reinforced Polymer Pipe

    a. Hobas USA, Houston, Texas,
    b. Flowtite USA, Rialto, California
    c. Or Accepted Equal.

5. Polyvinyl Chloride (PVC) Composite Pipe

    a. Contech Engineered Solutions, LLC,
    b. Or Accepted Equal.

B. Precast Concrete Manhole Structures

1. Mack Industries, Inc.
2. Independent Concrete Pipe Company,
3. Lindsay Precast Inc.,
4. Or Accepted Equal.

C. Manhole Frames and Covers

1. Neenah Foundry Inc., R-1642,
2. East Jordan Iron Works Inc., 1046Z or 1048Z frames with 1040A lid,

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3. Or Accepted Equal.

D. Manhole Steps

1. M.A. Industries, Inc., PS1-PF-DF 004-501-DF,
2. Or Accepted Equal.

2.2 GRAVITY SANITARY SEWER PIPE

A. Ductile Iron Pipe and Joints:

1. All ductile iron pipe shall be centrifugally cast Class 53 minimum or as identified on Contract Drawings.
2. Ductile iron fittings shall conform with AWWA C110/A21.10 or C153/A21.53AWWA C111/ANSI 21.11.
3. Material used for ductile iron pipe shall conform with ASTM A746.
4. Lining:
   a. The pipe, fittings, and joints shall be lined with Protecto 401 TM Ceramic Epoxy or Accepted Equal. The material shall be an amine cured novolac epoxy containing at least 20 percent by volume of ceramic quartz pigment.
   b. All pipe, fittings, and joints shall be delivered to the epoxy lining application facility without asphalt, cement lining, or any other lining on the interior surface. The entire interior of the pipe, fittings, and joints shall not have been lined with any substance prior to the application of the specified lining material and no coating shall have been applied to the first six inches of the exterior of the spigot ends.
   c. A permeability rating of 0.00 when tested according to Method A of ASTM E96, Procedure A with a test duration of 30 days.
   d. The following tests must be run on coupons from factory lined ductile iron pipe:
      1) ASTM B-117: Results to equal 0.00 undercutting after two years.
      2) ASTM G-95: 1.5 volts @ 77 degrees F. Results to equal no more than 0.5-mm undercutting after 30 days.
      3) Immersion testing rated using ASTM D-714-87.
         (a) 20 percent sulfuric acid: No effect after two years.
         (b) 140 degrees F 25 percent Sodium Hydroxide: No effect after two years.
         (c) 160 degrees F distilled water: No effect after two years.
         (d) 120 degrees F tap water (scribed panel): 0.0 undercutting after two years with no effect.
      4) ASTM G-22: Standard practice for determining resistance of synthetic polymeric materials to bacteria. The test should determine the resistance to growth of acidithiobacillus bacteria and should be conducted at 30 degrees C for a period of seven days on a minimum of four panels. The growth must be limited only to trace amounts of bacteria.
   e. An abrasion resistance of no more than three-mils (0.075 mm) loss after one million cycles using European Standard EN 598: 1994 Section 7.8 Abrasion Resistance.

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f. All ductile iron pipe and fitting linings shall be checked for thickness using a magnetic film thickness gauge. The thickness testing shall be done using the method outlined in SSPC PA-2 Film Thickness Rating.
g. The interior lining of all pipe barrels and fittings shall be tested for pinholes with a non-destructive 2,500 volt test. Any defects found shall be repaired prior to shipment.
h. Each pipe joint and fitting shall be marked with the date of application of the lining system along with its numerical sequence of application on that date and records maintained by the applicator of his work.

5. All pipe shall be furnished in 18- or 20-foot laying lengths, plus or minus one inch. No cut off pipe will be accepted.
6. Each pipe shall be subjected to a hydrostatic test pressure in accordance with ASTM A746.
7. Every pipe shall be marked in accordance with ASTM A746.
8. Joints:

a. Bell and spigot push-on joints, complete with gaskets and lubricants. Gaskets and lubricant for all joints furnished under these specifications shall be manufactured in accordance with ANSI A 21.11 (AWWA C 111).
b. When restrained joint pipe is specified on the construction drawings, the restrained joint shall be completely boltless (essentially boltless for greater than 36-inch size) and shall be rated at a working pressure up to 350 psi (up to 24-inch size) or 250 psi (greater than 24-inch size). The joint shall be capable of being deflected three degrees after assembly, with uniform load distribution between the restraining components when the joint is deflected.
c. The joint shall have a ductile iron lock ring welded to the plain end with a 360-degree continuous weld. All welds on field-cut pipe shall be made inside a shop by a certified welder. The joint shall be capable of being easily disassembled should the need arise. The joint shall meet all push-on joint requirements of the latest revision of ANSI A21.11 (AWWA C111).

B. Vitrified Clay Pipe and Joints

1. All pipes shall meet ASTM C700 requirements, extra strength.
2. Resilient and flexible joints shall meet ASTM C425 requirements.

C. Reinforced Concrete Pipe and Joints

1. All pipes shall meet ASTM C76 requirements.
2. All reinforced concrete pipe shall be manufactured using Type II Cement.
3. Marking: After the capital letter "D" designating the D-load, the design wall thickness in inches shall be expressed as a decimal. Pipe with "S" stirrups shall have the symbol S. Pipe requiring axis orientation without lift holes (i.e., stirrup pipe, quadrant reinforced pipe, elliptically reinforced pipe) shall have the center line of the crown of the pipe marked inside and outside with the symbol TB. Pipe with quadrant steel shall be marked with the symbol Q. Pipe with elliptical reinforcement shall be marked with the symbol E. Pipe with deformed wire reinforcement required in the design shall have the symbol DF.
4. Resilient and flexible gasket joints shall meet ASTM C443 requirements.
5. Resilient connectors between reinforced concrete manhole structures and pipes shall meet ASTM C923 requirements.

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6. Flexible Plastic Gasket: For concrete pipe, AASHTO M198, Type B, with the following exception:
    a. Flash point and fire point are waived.

D. Centrifugally Cast Fiberglass Reinforced Polymer Mortar Pipe (CCFRPMP) or Fiberglass Reinforced Polymer Mortar Pipe (FRPMP) and Joints (Note Where plans and specifications refer to CCFRPMP, either type is allowed):

1. Design, manufacture, and testing in accordance with ASTM D3262. Open cut portions of sewer pipe shall have a stiffness class which will satisfy all design requirements, but in no case be less than pipe stiffness of 72 psi when tested in accordance with ASTM D2412. Sewer pipe that is to be performed by pipe jacking shall have a factor of safety of 2.5 and an allowable safe jacking load of no less than 700 tons or per manufacturers recommendations.
2. Manufacture pipe by a centrifugal casting or filament process with computer-controlled material placement such that resultant product has a dense, nonporous, corrosive-resistant consistent composite structure.
3. The internal liner shall be suitable for service in a sewer pipe, and shall be highly resistant to exposure to sulfuric acid as produced by biological activity from hydrogen sulfide gases. Pipe shall meet or exceed requirements of ASTM D3681.
4. Pipe shall be supplied in nominal lengths of 20 - 25 feet. Actual lay length shall be nominal ±1 inch. Special short lengths may be used where surface geography or installation conditions require shorter lengths.
5. Wall thickness measured at the bottom of the spigot gasket groove shall be determined by the maximum load anticipated under all installation conditions. The average wall thickness of the pipe shall not be less than the nominal wall thickness published in the manufacturer's literature, and the minimum wall thickness at any point shall not be less than 87.5% of the nominal wall thickness.
6. Pipe ends shall be true and square to the pipe axis with a maximum tolerance of 1/8 inch.
7. Resin shall be a polyester resin system suitable for the service conditions.
8. Glass reinforcing fibers shall be of commercial grade E-glass filaments with binder and sizing compatible with the impregnating resin system.
9. Silica sand shall be a minimum of 98 percent by weight silica, with moisture content less than or equal to 0.2 percent.
10. Additives shall be of a proven result and of a nature which shall not degrade the finished product performance. Resin additives, such as curing agents, pigments, dyes, fillers, thixotrophic agents, etc., when used, shall not detrimentally effect the performance of the product.
11. Joints:
    a. Pipes shall be a filament wound composite (FWC) coupling configuration utilizing an elastomeric sealing gasket.
    b. Elastomeric sealing gaskets shall be suitable for the intended service and shall be produced and supplied by a manufacturer typically engaged in the manufacture of such materials conforming to ASTM F477.
    c. Joints shall meet the performance requirements of ASTM D4161.

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12. Fittings, Miters, and Specials:
    a. Changes in pipe alignment not located at manholes shall be made with manufactured miters or fittings or use of short pipe sections.
    b. Any pipe fittings, miters, and specials shall be provided by the pipe manufacturer, as shown on the drawings and/or as required by the service conditions (including connection to existing piping).
13. Connections:
    a. The pipe shall be field connected with glass reinforced plastic sleeve couplings that utilize elastomeric sealing gaskets as the sole means to maintain joint water tightness. The joints shall utilize elastomeric sealing gaskets meeting the performance requirements of ASTM D4161.
    b. Connections made to existing service laterals, side sewers, or manholes from within the pipe shall be made in accordance with the Contract Drawings and manufacturer's recommendations.
14. Connection or closure details for the aforementioned conditions shall be submitted to CMT for review and approval. Connection or closure details shall be in accordance with industry standards, and material manufacture specifications.
15. Pipe and joints used for direct jack installation shall be manufactured to support all additional loading conditions as specified elsewhere.

E. PVC Composite Pipe and Joints

1. Pipe and fittings shall conform to ASTM D2680, with the following additions and exceptions:
    a. Joints shall be gasketed conforming to ASTM D3212, using elastomeric gaskets conforming to ASTM F477. Use only lubricant supplied or recommended for use by the pipe manufacturer. Verify that the ends of the pipe are marked to indicate insertion stop (home) position, and ensure that pipe is inserted into pipe or fitting bells to this mark. Protect the end of the pipe during homing and do not use excessive force that may result in over-assembled joints or dislodged gaskets. If full insertion is not achieved, disassemble and clean the joint and reassemble. All pipe ends shall be properly sealed prior to joining the pipe using a material recommended by the pipe manufacturer.
    b. Factory made fittings must be used on all house connections or other connections. Bedding material for house connections (sanitary sewer house laterals) shall be equal to that of the main sewer. Risers in deep or unstable trenches should be embedded in Class I materials only. Brackets or anchors shall be used to hold end caps or plugs in place on sanitary sewers for the purpose of withstanding air test pressures. Caps or plugs shall not be chemically welded in place.
    c. All pipe and fittings shall be suitably marked to provide manufacturer's name, lot or production number, ASTM designation, ABS, nominal diameter and SDR number. Fittings need not contain the lot or production number. Pipe shall have a "home" mark. Composite pipe with an absence of filler material at the ends greater than¼-inch deep shall be subject to rejection or must be repaired, if required, to an acceptable condition.

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F. PVC Pipe and Joints

1. Pipe and fittings shall conform to ASTM F679 for 18-inch to 48-inch pipe.
2. Pipe and fittings shall conform to ASTM D3034 for four-inch to 15-inch pipe, with the following additions and exceptions:
    a. All pipe and fittings for sanitary sewers shall conform to SDR 26 for mainline and SDR 23.5 for laterals.
3. All joints shall be of the elastomeric gasket type, and shall be assembled per manufacturer's recommendations and ASTM D3212. Care shall be taken to ensure all joints are being pushed to the full "home" position and held tightly in the "home" position during any grade or line adjustments.
4. Factory made fittings must be used on all house connections or other connections. Bedding material for house connections (sanitary sewer house laterals) shall be equal to that of the main sewer. Risers in deep or unstable trenches shall be embedded in Class I materials only. Brackets or anchors shall be used to hold end caps or plugs in place on sanitary sewers and house laterals for the purpose of withstanding air testing pressures. Caps or plugs shall not be chemically welded in place.
5. All pipe and fittings shall be suitably marked to provide manufacturer's name or trademark, lot or production number, ASTM designation, PVC cell classification, SDR number (if applicable) and nominal diameter. Fittings need not contain a lot number, cell classification or SDR number (if applicable). Pipe shall have a "home" mark.

2.3 PRECAST CONCRETE MANHOLES

A. All manholes on sanitary sewers shall be precast reinforced concrete risers with cast-in-place concrete base slabs.

B. All precast reinforced concrete manholes shall be manufactured using Type II cement.

C. Precast concrete manholes on sanitary and combination sewers shall be epoxycoated as indicated on the Contract Drawings and shall be installed with a full depth channel constructed of precast concrete (using Type II cement), pour in place concrete (using Type II cement), or vitrified brick with mortar joints not more than ¼-inch wide. Slab top manholes shall be as indicated on the Contract Drawings.

D. Precast reinforced concrete manhole riser sections: ASTM C 478.

1. Joints. ASTM C 443.
2. Compression Tests. Compression tests for satisfying the minimum specified concrete strength requirements shall be made from cores not less than 3½ inches in diameter drilled from the wall of the risers, cones or tops. Cores shall be obtained, prepared for testing, and tested by the appropriate methods of AASHTO T 33.

E. Contractor shall construct manholes complete, in accordance with the Contract Drawings, including castings, covers, slab tops, steps, plastering, pointing, interior coating, joint sealing and all incidentals. The inlet and outlet treatment of pipe at manholes shall be in accordance with the Contract Drawings and shall be included in the price bid per linear feet of the appropriate pipe item. Pipe, fittings, concrete or masonry required for drop connections shall

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be included in the price bid for drop manholes complete. Sanitary manhole types shall be as designated on the Contract Drawings.

2.4 MANHOLE FRAME AND COVERS

A. Frames, covers, and related appurtenances shall meet AASHTO M-306.

B. Bearing parts of frames and covers shall be machined to provide a firm and even seat for any position of the cover.

C. Frames and covers shall not vary more than 1/16 inch per foot in any dimension or more than 5 percent in weight from those called for by the manufacturer and be free of all defects.

D. Frames and covers shall be marked to show the manufacturer's name, part number, and cast date in cast-on letters/numbers.

E. Step treads shall have sharp well defined checks and all corners shall be round.

F. Manhole steps for precast manholes shall conform with ASTM C478 and shall be polypropylene. Propylene plastic shall conform to ASTM D 4104. The manufacturer shall furnish certified test data for the propylene plastic used in each lot of steps.

G. Solid manhole covers shall be used for sanitary sewers.

H. Identify covers with cast marking as "CITY OF AKRON, SEWER."

I. Provide casting free of blowholes, splits, cracks, blisters, mold-pull, and other imperfections affecting strength or serviceability.

J. The manhole frame shall be set in a full bed of mortar and, if appropriate, adjusted to conform to the surface of the roadway. Care shall be taken with setting and adjusting the frame in order to maintain a full and firm bearing on the mortar bed.

K. When directed by CMT or noted on the Contract Drawings, manholes shall have locking covers.

2.5 BEDDING AND COVER MATERIALS

A. Bedding shall be compacted to not less than 95% of the maximum dry density at +/-2% of optimum moisture content.

2.6 APPURTENANCES

A. Provide all necessary appurtenances for a full and complete piping system suitable for operation, and in conformance with Contract Documents

2.7 SHOP PAINTING COATINGS

A. For Ductile Iron Pipes:

1. All pipe shall have an asphaltic-based seal coat applied to the exterior surface.

B. For Reinforced Concrete Pipes:

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1. The interior barrel and joint surface areas of the concrete pipe for sanitary sewers shall be prepared as per manufacturer's recommendations so as to remove all forms of oil, laitance and other deleterious materials. Concrete must be etched with a 15 to 20 percent muriatic acid solution or brush blasted to achieve a medium grade profile. The surface so prepared shall then be lined with a high build, polyamide-cured, two-component coal tar epoxy coating "Bitumastic No. 300-M" as manufactured by Koppers Company, Inc., Pittsburgh, Pennsylvania 15219, or an Accepted Equal, each meeting military Specification DOD-P-23236A (SH), Type 1, Class 2.
2. The lining compound shall be sprayed two or more coats with a minimum of ten to 12 dry mils (12 to 14 wet mils) per coat to obtain a continuous and relatively uniform and smooth lining.
3. The total dry film thickness should not be less than 20 mils (0.02 inches).
4. Additional coatings may be necessary for pipes to be laid on steep grades or within industrial areas, as shown on the Contract Drawings.
5. All coated pipe shall be free of surface irregularities such as air bubbles, delaminations, lumping, sagging, blistering, pinholes or porosity in the coating film.

2.8 SHOP TESTING

A. Test all pipes per manufacturer requirements, and as required by pertinent standards.

PART 3 EXECUTION

3.1 EXAMINATION

A. For reinforced concrete pipe:

1. Acceptance: Concrete pipe may be judged for acceptance on the basis of cores cut from the pipe wall.
2. Visual Inspection: The core shall be examined for reinforcing steel area and spacing, steel position as to cover depth, lack of bond between cement paste and reinforcing steel, and void around the reinforcing steel.
3. Void Inspection: If voids are found larger than one-quarter of the diameter of the reinforcing steel and extending along the steel throughout the core diameter, the pipe will be subject to retest. If the same condition is found in the retest pipe, the pipe will be rejected.
4. Test Specimens: The pipe to be cored will be the same as tested for three edge bearing test and the retest pipe will be two for one the same as ASTM C 76.

3.2 PREPARATION

A. Sanitary sewer pipe

1. For all rigid pipe installations, the width of the trench at the top of the pipe shall not exceed the outside pipe diameter, including bells, plus the clear width on each side of the pipe as listed in Table 33 30 00-1:

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2. For all non-rigid pipe installations, the minimum trench width shall be per the pipe manufacturer's recommendations, but at no time shall the width be less than that specified in ASTM D2321.
3. The length of trench or tunnel open at any one time shall conform to the limits accepted by Owner. In general, not more than 100 feet of trench shall be opened in advance of the completed work.
4. Where the sewer pipes are built upon the surface of the ground, the surface shall be grubbed and cleared of all stumps, grass, muck, or other vegetable matter.
5. Pipes shall not be constructed on frozen ground.

Table 03 33 00-1

Pipe Size (in)	Maximum Clear Width (in)
6 – 24	12
27 – 54	15
60 and over	24

3.3 SANITARY SEWER PIPE INSTALLATION

A. Pipe shall be laid accurately to the line and grade designated on the Contract Drawings. Pipe shall be carefully centered so that when laid it will form a sewer with close fitting joints.

B. All pipe shall begin and end with pipe ends as normally fabricated by the manufacturers. If field cutting pipe is required, cutting shall be performed by the use of tools or equipment that will provide a neat perpendicular cut with a beveled end without structural damage to the pipe wall or damage to coatings or fillers.

C. For Ductile Iron pipes:

1. Installation of ductile iron pipes shall conform to AWWA C600 unless otherwise noted on Contract Documents.
2. Remove and replace defective pieces.
3. Clear of all debris and dirt before installing and keep clean until accepted.
4. For push-on joints, clean bell of excess tar or other obstruction and wipe out before inserting next pipe spigot. Shove pipe into place until properly seated and hold securely until joint completed.
5. Temporary Plugs: When pipe laying not in progress, close open ends of pipe with temporary watertight plugs. If water in trench, do not remove plug until danger of water entering pipe passed.
6. Appurtenances: Set fittings and appurtenances as indicated on Contract Drawings.
7. Polyethylene wrapping: All buried ductile iron piping shall be polyethylene wrapped in accordance with pipe manufacturer's written instruction.

D. For Reinforced Concrete pipes:

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1. Installation of reinforced concrete pipe shall conform to ASTM C1479 unless otherwise noted in Contract Documents.
2. Reinforced concrete pipe with auxiliary supports shall be handled and placed with the centerline of the auxiliary support system in a vertical plane.
3. Care shall be taken with all precut holes, fittings, specials, etc. to ensure that they are placed at the location and elevation indicated on the Contract Drawings.
4. It is intended that curves in 30-inch or larger diameter reinforced concrete pipe sewers be truly circular. This work shall be monolithic construction of concrete unless otherwise specified on the Contract Drawings. The use of radius pipe or cut curves may be permitted where the alignment shown on the Contract Drawings can be maintained, and a shop drawing of the cut curves or radius pipe illustrating the layout and geometry is accepted by Owner.
5. Where bracing plates or a trench box is used for the installation of pipe, all voids caused by the withdrawal of the bracing plates or the trench box shall be completely filled.
6. All lifting holes in reinforced concrete circular pipe shall be grouted with cement mortar or other approved material after the pipe has been placed.

E. For CCFRPM pipes:

1. Installation of CCFRPM pipe shall conform to ASTM D3839 unless otherwise noted on Contract Documents.
2. Remove, replace or repair pieces of pipe discovered to be defective. Repairs shall be made only if accepted by Owner.
3. Clear of all debris and dirt before installing and keep clean until accepted.
4. Pipe shall be installed in the trench as recommended by the pipe manufacturer and accepted by Owner.
5. Lay accurately to lines and grades indicated or required. Provide accurate alignment, both horizontally and vertically.
6. Install all joints and couplings in accordance with manufacturer’s directions.
7. Clean ends of pipe and joint and coupling components.
8. Apply joint lubricant to the bell interior surface and the elastomeric seals. Use only lubricants approved by the pipe and gasket manufacturers.
9. Direct jack or pipe in tunnel installations shall be as specified elsewhere.

F. For PVC pipes:

1. Installation of all sizes of PVC pipe shall conform to ASTM D2321 unless otherwise noted on Contract Documents.
2. Factory made fittings must be used on all house connections or other connections. Bedding material for house connections (sanitary sewer house laterals) shall be equal to that of the main sewer. Risers in deep or unstable trenches shall be embedded in Class I materials only. Brackets or anchors shall be used to hold end caps or plugs in place on sanitary sewers and house laterals for the purpose of withstanding air testing pressures. Caps or plugs shall not be chemically-welded in place.
3. Remove and replace defective pieces.
4. Clear of all debris and dirt before installing and keep clean until accepted.

G. Joining pipes

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1. Before joining pipe with a coupling or bell end, all surfaces of the portions of the pipe to be joined and all surfaces of factory made jointing materials shall be clean and dry. Lubricants, primers, adhesives, solvents, bolts, etc. shall have been manufactured specifically for their intended use and shall be used as recommended by the pipe and/or pipe joint manufacturer. The jointing materials shall be fitted and adjusted or applied in such a manner as to obtain a close fitting joint and to obtain the degree of water tightness required.
2. Where the joining of pipes of different materials is required or approved, this work shall be done utilizing special adapters and couplers manufactured specifically for this purpose. The adapters and couplers shall be installed and securely attached to both pipe barrels according to manufacturers' recommendations.
3. As soon as possible after a joint is made, sufficient backfill materials shall be placed along each side of the pipe to support the pipe in its final position.
4. Where a pipe stub or run of pipe is to be temporarily terminated for future extension, the end of the pipe shall be sealed using an approved removable plug.

H. Where required by the Contract Drawings, flexible pipe shall be elongated by increasing its vertical diameter by five percent. The vertical elongation shall be maintained by horizontal wire struts that shall be left in place until the embankment is completed.

3.4 PRECAST CONCRETE MANHOLE INSTALLATION

A. Contractor shall submit the following:

1. Manufacturer's name and address
2. Detailed shop drawings
3. Material specifications

B. Approval will be based on complete inspection of manufacturer's plant, method of manufacture, samples of materials to be used and inspection and testing of actual units to be used.

C. The manhole bottom shall have a uniform bearing on a minimum of three inches of compacted #57 stone. Unsuitable material shall be removed and replaced.

D. Adequate precautions shall be taken to prevent concrete and/or mortar from freezing. Any material incorporated in these items having a temperature of 40 degrees F or less shall not be placed until heated for a period sufficient to ensure a temperature of 50 degrees F to80 degrees F throughout the entire mass of the material. Refer to Section 03 30 00 Cast-in-Place Concrete for additional requirements.

E. Standard manhole steps shall be set in the cones of precast manholes as indicated on the Contract Drawings. Where the ordinance grade is below the grade of an unimproved street, the last precast section shall be built to correspond with the ordinance grade, and the manhole casting and cover set to existing grade by use of a brick chimney and/or grade rings. The inside diameter of the precast section shall be not less than 26 inches nor more than 28 inches.

F. All manholes shall be thoroughly bonded or securely connected to the barrel of the sewer, and all connections with pipes neatly made without projections or voids. Unless otherwise noted

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on the Contract Drawings, all pipe connected to precast concrete manholes shall be sealed by use of a resilient manhole connector meeting the requirements of ASTM C923.

G. When manholes are completed, they shall be cleared of scaffolding, centering or forms and cleaned of surplus mortar or other foreign materials.

H. Manholes on sanitary sewers shall be tested by Contractor. Testing shall be performed in accordance with ASTM C1244.

3.5 REPAIR RESTORATION

A. All surfaces affected by the construction work shall be permanently restored.

B. Before Final Completion, CONTRACTOR shall clean up the Work area.

3.6 FIELD TESTING

A. General:
   1. Remove all dirt, dust, oil, grease and other foreign material before initiating testing and acceptance procedures.
   2. Perform leakage tests and measurements according to applicable standards.

B. Low Pressure Air Test:

   1. All sewers, manholes or other structures and appurtenances which are to be used for sanitary sewage shall at all times be water tight and not permit the infiltration of water into, or the exfiltration of sewage therefrom. All such sewers shall be subject to an air leakage test to be performed by CONTRACTOR, under the direct observation of CMT, unless otherwise noted No request by CONTRACTOR for waiver of the test will be considered. The cost of all air-leakage testing shall be included in the unit price bid for the pipe.
   2. The air test shall be performed within a reasonable time after completion of the sewer, or sections of a large portion of the sewer installation, before the Substantial Completion. CONTRACTOR shall verify that the sewers, manholes, etc. are substantially complete and reasonably clean prior to performing the test.
   3. The testing procedure and criteria shall be in accordance with ASTM C828 (clay pipe – for pipe up to 42-inch diameter), C924 (concrete pipe and ductile iron pipe – for pipe sizes up to 24-inch diameter), or F1417 (plastic pipe), as applicable, and Table 33 30 00-2 which shows the minimum test time in minutes per 100 feet of pipe for each nominal pipe size for a 1.0 psi pressure drop from 3.5 to 2.5 psi. Testing procedures and criteria for PVC pipe shall be in accordance with ASTM D3212. All sanitary sewer manholes shall be tested in accordance with ASTM C1244.
   4. If the sewer fails to meet the minimum test times shown in Table 33 30 00-2, Owner may order CONTRACTOR to expose and repair as required joints or any section in the test, backfill, and restore the surface. Such additional work shall be at CONTRACTOR's expense. Following the repairs, the sewer shall be retested until the minimum test time is equaled or exceeded.
   5. In the event that the pipe fails to meet the test requirements, no payment to exceed 75 percent of the price bid for the pipe items shall be made until the sewer(s) satisfactorily

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passes the low pressure air test. Passing an air test or making repairs and passing an air test does not release CONTRACTOR from the responsibility of repair or replacement of sewers and appurtenances during the Warranty Period.

Table 33 00-2

Nominal Pipe Size (in)	Time, T (min/100 ft)	Nominal Pipe Size (in)	Time, T (min/100 ft)
3	0.2	21	3
4	0.3	24	3.6
6	0.7	27	4.2
8	1.2	30	4.8
10	1.5	33	5.4
12	1.8	36	6
15	2.1	39	6.6
18	2.4	42	7.3

C. Individual Joint Test

1. For CCFRPM pipe 48-inch diameter or larger, individual joint testing shall conform with ASTM C1103.
2. For reinforced concrete pipe 27-inch diameter or larger, individual joint testing shall conform with ASTM C1103.

D. Deflection Test:

1. All sewers 48-inch diameter or smaller constructed using non-rigid pipe materials shall be subject to a pipe deflection test, regardless of the pipe stiffness, to be performed by CONTRACTOR. No request by CONTRACTOR for waiver of the test will be considered.
2. The deflection test will be performed at the end of the Warranty Period before release of the retainer or bond. The test shall consist of pulling a mandrel (Go/No Go) device through the sewer by hand. No mechanical pulling devices shall be used. The mandrel shall be either the full circle or 9-arm type and conform to the dimensions noted in Table 33 30 00-3. No sewer will be accepted if the pipe deflection at any point is in excess of 5 percent of its average inside diameter as noted in Table 33 30 00-3, where T-1 equals Cell Classification 12454C and T-2 equals Cell Classification 12364C.
3. All sewers larger than 48-inch diameter constructed of non-rigid material shall be entered to conduct deflection measurements directly using extension rulers, tape measures, etc. at 10-foot increments, using the same deflection criteria used for the mandrel device.
4. All portions of sewer found to exceed this limit shall be replaced or repaired by CONTRACTOR promptly in a manner approved by the Owner. After a period of at least 60 days after backfilling the repaired area(s), the sewer shall again be tested for deflection.

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This procedure shall be repeated as necessary until the maximum pipe deflection is 5 percent or less. CONTRACTOR shall bear the total cost of all repairs or replacement, including surface restoration.

Table 33 30 10-3

	ASTM D-3034		ASTM D-2680		ASTM F-679	
Minimal Pipe Size (in)	Average I.D. (in)	5% Deflection Mandrel (in)	Average I.D. (in)	5% Deflection Mandrel (in)	Average I.D. (in)	5% Deflection Mandrel (in)
6	5.893	5.598				
8	7.891	7.496	7.75	7.35		
10	9.864	9.371	9.75	9.25		
12	11.737	11.15	11.75	11.16		
15	14.374	13.655	14.75	14.01		
					T-1	
18					18.165	17.257
21					21.415	20.344
24					24.092	22.887
27					27.152	25.794
					T-2	
18					18.202	17.292
21					21.459	20.3896
24					24.142	22.935
27					27.208	25.848

E. Closed Caption Television (CCTV) Inspection:

1. All sewers, manholes, inlets and other appurtenances shall be subject to CCTV and visual inspections, to be performed by CONTRACTOR, prior to Substantial Completion of the sewer items. No request by CONTRACTOR for waiver of the inspections will be considered.
2. The CCTV inspections shall be performed after completion of the sewer items, before the Substantial Completion and release of the retainer or bond. CONTRACTOR shall verify that the sewers and manholes are substantially complete and reasonably clean prior to performing the inspection.
3. CCTV inspections shall be performed in accordance with National Association of Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP), latest edition.

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4. All pipe, manholes, and appurtenances found to be defective shall be replaced or repaired by CONTRACTOR promptly. CONTRACTOR shall bear the total cost of all repairs or replacement.
5. Passing the CCTV inspection or making repairs and passing the CCTV inspection does not release CONTRACTOR from the responsibility of repair or replacement of sewers and appurtenances during the Warranty Period.
6. Submit the following information prior to Substantial Completion:
    a. Database file with inspection event and defect records in Microsoft Access (.MDB) (Granite native export database, PACP 4.2 schema-compliant database, or Accepted Equal)
    b. Video file: MPEG (.mpg) or Windows Media file (.wmv). One video file per pipe inspection
    c. Inspection report: One report in Adobe Acrobat PDF format per pipe inspection. Report should include: 1) Inspection header info (who, what, where, when) (2) Defect log (3) Photos of defects
    d. Defect photos: screen captures from the video (.jpg)

3.7 FIELD PAINTING COATINGS

A. Repair any shop painting/coatings damaged during storage or installation.

3.8 PROTECTION

A. Protect sanitary sewers from damage throughout storage, installation, testing, and Final Completion.

END OF SECTION 33 30 00

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SECTION 33 40 00 – STORMWATER UTILITIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. PE pipe and fittings.
2. PVC pipe and fittings.
3. Concrete pipe and fittings.
4. Cleanouts.
5. Drains.
6. Catch basins.
7. Stormwater inlets.
8. Pipe outlets.
9. Perforated-wall pipe and fittings.
10. Drainage conduits.
11. Soil materials.

1.3 DEFINITIONS

A. HDPE: High Density Polyethylene

B. PE: Polyethylene

C. PVC: Polyvinylchloride

1.4 ACTION ASSURANCE

A. Product Data: For each type of product.

B. Shop Drawings:

1. Catch basins, pipe, fittings, cleanouts, and bedding material. Include plans, elevations, sections, details, frames, covers, and grates.

1.5 QUALITY ASSURANCE

A. Piping materials shall bare label, stamp, or other markings of specified testing agency.

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1.6 DELIVERY, STORAGE AND HANDLING

A. Do not store plastic pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle catch basins in accordance with manufacturer's written rigging instructions.

1.7 FIELD CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service in accordance with requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of service. See Plans for contact information.
2. Do not proceed with interruption of service without Owner's written permission

PART 2 PRODUCTS

2.1 CORRUGATED PE PIPE AND FITTINGS

A. Source Limitations: Obtain corrugated PE pipe and fittings from a single manufacturer.

B. Corrugated PE Drainage Pipe and Fittings NPS 3 to NPS 10: AASHTO M 252, Type S, with smooth waterway for coupling joints.

C. Corrugated PE Pipe and Fittings NPS 12 to NPS 60: AASHTO M 294, Type S, with smooth waterway for coupling joints.

D. Corrugated PE Silttight Couplings: PE sleeve with ASTM D1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.

E. Corrugated PE Soiltight Couplings: AASHTO M 294, corrugated, matching pipe and fittings.

2.2 PVC PIPE AND FITTINGS

A. Source Limitations: Obtain PVC pipe and fittings from a single manufacturer.

B. NSF Marking: Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic storm drain and "NSF-sewer" for plastic storm sewer piping.

C. PVC Type PSM Sewer Piping

1. Pipe: ASTM D3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D3034, PVC with bell ends.
3. Gaskets: ASTM F477, elastomeric seals.

D. Adhesive Primer: ASTM F656.

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2.3 CLEANOUTS

A. PVC Cleanouts:

1. Source Limitations: Obtain PVC cleanouts from single manufacturer.
2. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.4 DRAINS

A. Cast-Iron Area Drains:

1. Source Limitations: Obtain cast-iron area drains from single manufacturer.
2. Top-Loading Classification(s): Medium Duty.

2.5 CONCRETE

A. General: Cast-in-place concrete in accordance with ACI 318, ACI 350, and the following:

1. Cement: ASTM C150/C150M, Type II.
2. Fine Aggregate: ASTM C33/C33M, sand.
3. Coarse Aggregate: ASTM C33/C33M, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.50 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A1064/A1064M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A615/A615M, Grade 60 (420 MPa) deformed steel.

2.6 CATCH BASINS

A. Standard Precast Concrete Catch Basins:

1. Description: As specified in the plans.

B. Frames and Grates: as specified in the Plans.

2.7 PIPE OUTLETS

A. Head Walls: Cast-in-place reinforced concrete, as per ODOT Standard Construction Drawing HW-2.1.

B. Erosion Protection: ODOT Type C Rock Channel Protection, as per plan details.

2.8 PERFORATED-WALL PIPES AND FITTINGS

A. Perforated PE Pipe and Fittings:

1. NPS 6 and Smaller: ASTM F405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
2. NPS 8 and Larger: ASTM F667; AASHTO M 252, Type CP; or AASHTO M 294, Type CP; corrugated; for coupled joints.
3. Couplings: Manufacturer's standard, band type.

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B. Perforated PVC Sewer Pipe and Fittings: ASTM D2729, bell-and-spigot ends, for loose joints.

2.9 SOIL MATERIALS

A. Soil materials are specified in Section 312000 "Earth Moving”.

PART 3 EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving”.

3.2 PIPE INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

D. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

E. Install gravity-flow, nonpressure drainage piping in accordance with the following:

1. Install piping pitched down in direction of flow.
2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
3. Install PE corrugated sewer piping in accordance with ASTM D2321.
4. Install PVC sewer piping in accordance with ASTM D2321 and ASTM F1668.
5. Behind-Curb Subdrainage: Install piping pitched down in direction of flow, at a minimum slope and with a minimum cover as shown in the Plan Details.
6. Lay perforated pipe with perforations down.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping in accordance with the following:

1. Join corrugated-PE piping in accordance with ASTM D3212 for push-on joints.
2. Join PVC sewer piping in accordance with ASTM D2321 and ASTM D3034 for elastomeric-seal joints or ASTM D3034 for elastomeric-gasketed joints.

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3. Join perforated PE pipe and fittings with couplings according to ASTM D3212 with loose banded, coupled, or push-on joints.
4. Join perforated PVC sewer pipe and fittings according to ASTM D3212 with loose bell- and-spigot, push-on joints.

3.4 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.

B. Set cleanout frames and covers as per the Plan Details.

3.5 DRAIN INSTALLATION

A. Install type of drains in locations indicated.

1. Use Light-Duty, top-loading classification drains in earth or unpaved foot-traffic areas.

B. Fasten grates to drains if indicated.

3.6 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.7 STORMWATER OUTLET INSTALLATION

A. Construct riprap of broken stone, as detailed in the Plans.

3.8 CONCRETE PLACEMENT

A. Place cast-in-place concrete in accordance with ACI 318.

3.9 CONNECTIONS

A. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength as specified in Plans.
2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

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3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
    a. Use concrete that will attain a minimum 28-day compressive strength as indicated in the Plans.
    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.10 UNDERDRAINS AND BEHIND-CURB DRAINAGE INSTALLATION

A. Provide trench width as shown in plan details. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.

B. Install drainage conduits pitched down in direction of flow, at a minimum slope and with a minimum cover as indicated in the Plans.

C. Add drainage course to top of drainage conduits.

D. Cover drainage conduit to within 6 inches of finish grade.

E. Fill to Grade: Place satisfactory soil fill material over drainage course. Place material in loose lifts not to exceed 6 inches. Thoroughly compact soil fill material. Fill to finish grade.

3.11 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:
    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Re-inspect and repeat procedure until results are satisfactory.

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3.12 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with water.

3.13 PROTECTION

A. The Contractor shall be responsible for protecting site storm sewer/underdrains and appurtenances throughout construction. Any/all damage caused to storm sewer/underdrains systems during construction shall be repaired by the Contractor, at no cost to the Owner.

END OF SECTION 33 40 00

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Professional Service Industries, Inc.
5555 Canal Rd., Cleveland, OH 44125
(216) 447-1335 (P)

December 15, 2025

Mr. Eric Herman
Capital Projects Manager
Cleveland Public Library
325 Superior Avenue
Cleveland, Ohio 44114
Email: eric.herman@cpl.org

Re: Geotechnical Engineering Services Report
Proposed Building Addition
Fleet Branch Renovation and Expansion
7224 Broadway Avenue
Cleveland, Cuyahoga County, OH 44105
PSI Project No.: 0142-2962

Dear Mr. Eric Herman:

Per your request, Professional Service Industries, Inc. (PSI) is pleased to submit this Geotechnical Engineering Services Report for the above referenced project. The results of the field exploration and laboratory testing, together with our geotechnical related recommendations and general construction guidance, are to be found in the accompanying report.

After the plans and specifications are complete, PSI should review the final design and specifications in order to verify that our geotechnical-related recommendations and construction guidance are properly interpreted and implemented. **It is considered imperative that the Geotechnical Engineer and/or its representative be present during earthwork operations and foundation installations to observe the field conditions with respect to the design assumptions and specifications. PSI will not be held responsible for interpretations and field quality control observations made by others.**

If you have any questions pertaining to this report, please contact our office at (216) 447-1335. PSI would be pleased to continue providing geotechnical services throughout the implementation of the project, and we look forward to working with you and your organization on this and future projects.

Respectfully submitted,
PROFESSIONAL SERVICE INDUSTRIES, INC.

Digitally signed by Robert Lee Price Jr., PE
Date: 2025.12.23 09:16:16 -05'00'

STATE OF OHIO
ROBERT LEE PRICE JR.
PE.91273
REGISTERED
PROFESSIONAL ENGINEER

Ryan Karrip
Ryan Elijah Karrip
Project Manager

Robert L. Price, Jr. BC.GE, PE
Principal Consultant/Regional Engineer

Geotechnical Engineering Services Report

For the Proposed

Cleveland Public Library
Fleet Branch Renovation and Expansion
7224 Broadway Avenue
Cleveland, Cuyahoga County, OH 44105

Prepared for

Cleveland Public Library
325 Superior Avenue
Cleveland, Ohio 44114

Prepared by

Professional Service Industries, Inc.
5555 Canal Road
Cleveland, OH 44125

PSI Project No. 0142-2962

Ryan Elijah Karrip
Project Manager

Reviewed By:

Robert L. Price, Jr. BC.GE, PE
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1 PROJECT INFORMATION

1.1 PROJECT AUTHORIZATION

This Geotechnical Engineering Services Report presents the results of a subsurface exploration and geotechnical evaluation conducted for Cleveland Public Library in connection with the proposed Cleveland Public Library Additions. The project is to be constructed at 7224 Broadway Avenue in the City of Cleveland, Cuyahoga County, Ohio. PSI's services for this project were performed in accordance with PSI Proposal No. 0142-463388, dated November 7th, 2025. Our services were authorized by Mr. Felton Thomas, CEO, Cleveland Public Library.

1.2 PROJECT DESCRIPTION

Based on the information provided by the client, the project entails the construction of two building additions for the Cleveland Public Library. The additions include two single-story, slab-on-grade additions. One addition will be located on the north-eastern side of the existing building at 7224 Broadway Avenue, and will house a vestibule. The southern side of the existing building and will house an innovation room, storage area, and study. The project sites are located in Cleveland Township, Cuyahoga County, Ohio and approximately as shown in the Boring Location plan given in the ***Appendix.***

PSI understands that proposed project includes the construction of single-story, slab-on-grade additions with a plan area of approximately 609.95sq. ft. for the vestibule addition and a single-story, slab-on-grade addition with a plan area approximately 546.05 sq. ft for the innovation room, storage area, and study. The proposed project site is surrounded by roadways to the south-east and north-east, and a parking lot to the west and northwest. It is further understood that the additions will not include a basement level, be used for heavy storage, or house sensitive equipment or vibration inducing machinery. In view of this, it is necessarily assumed that the structural design loads of the proposed building are anticipated to be nominal and typical of facilities of similar type, size, function, use, and construction materials. Structural loads were not available at the time of this report. The report is based on column loads of 100 kips and continuous loads of 3-5 klf .

Based on the topographic and grading information provided in the Preliminary Civil Plan Set, (Sheet C6), the overall site surface is relatively flat with a grade difference of Elev. 723 ft. to 724 ft, MSL within the proposed building footprints. PSI anticipates the finished floor elevations (FFE) of the proposed building additions to be near the existing finished floor elevations, approximately Elev. 723 feet, MSL. Therefore, PSI anticipates minimal site grading will be required to achieve the design grade within the footprint of the proposed addition. It should be noted that PSI's anticipated cut depth and fill thickness are approximate and based on the limited information provided by the Client. Calculation of actual required cut/fill volumes and earthwork takeoff quantities should be the responsibility of others.

The geotechnical recommendations and general construction guidance presented in this report are based on the available project information, the proposed orientation and locations of the project elements on the site, and the subsurface materials encountered at the exploration locations as described in this report. If any of the information we have been given or have assumed is incorrect, please inform PSI in advance and in writing so that we may amend the recommendations presented accordingly. PSI will not be responsible for the implementation of its recommendations when it is not notified in advance and in writing of pertinent changes in the project.

1.3 PURPOSE AND SCOPE OF SERVICES

The purpose of our geotechnical services was to explore the subsurface conditions at the site and to prepare recommendations for foundations and floor slab systems for the proposed development. PSI's scope of services included a subsurface exploration by drilling three (3) soil test borings to depths of approximately 24 feet below the existing surface grades (bsg), performing geotechnical laboratory testing, and preparing this Geotechnical Engineering Services Report. PSI's subsurface exploration proposed drilling two (2) soil test borings within the footprint for the vestibule addition and one (1) borings within footprint for the secondary addition. Two of these borings (B-1 and B-3) involved the coring of 5 feet of bedrock at the bottom of the boring (10 feet of coring total). One pavement core was taken inside the existing building, just within the entryway. This was done to assess pavement and base materials present within the building's current footprint. This report briefly outlines the field and laboratory testing procedures, presents available project information, describes the general site and subsurface conditions, and presents recommendations regarding the following:

- Review of geologic setting
- Site grading recommendations for placement and compaction of fill, including an assessment of the suitability of the existing on-site soils for use as fill material
- Geotechnical recommendations for design and construction of foundations
- Recommendations for foundation types and allowable bearing pressure and foundation settlement tolerances
- Seismic site class determination (per the 2021 International Building Code)
- Floor slab recommendations and subgrade modulus
- Pavement section thickness recommendations
- Construction considerations, including control of groundwater and other subsurface conditions which could possibly impact construction activities

The geotechnical scope of services did not include an environmental assessment for determining the presence or absence of wetlands, or hazardous or toxic materials in the soil, bedrock, surface water, groundwater, or air on, below, or around this site. Any statements in this report or on boring logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes. PSI's geotechnical scope also did not include any service to investigate or detect the presence of moisture, mold, or other biological contaminants in or around any structure, or any service that was designed or intended to prevent or lower the risk of the occurrence or the amplification of the same. Client should be aware that mold is ubiquitous to the environment with mold amplification occurring when building materials are impacted by moisture, that site conditions are out of PSI's control, and that mold amplification will likely occur, or continue to occur, in the presence of moisture. As such, PSI cannot and shall not be held responsible for the occurrence or recurrence of mold amplification.

PSI's scope of services did not include performing environmental sampling or detailed analytical testing of soil and/or groundwater samples. In view of the former and present uses of the site and the possible presence of near surface fill materials, analytical testing of soil and water samples is believed prudent to determine if they contain any elevated levels of contaminants or pollutants above the regulatory requirements. Analytical testing is also recommended to delineate the potential of the near surface soils to induce corrosion and/or chemical attack on the various structural elements (i.e., steel, concrete, etc.) of the proposed building. Even if it is decided to remove any near surface fill materials, it remains advisable to sample and test the exposed "native soil" subgrade for any possible contamination with leachates emanating from the overlying fill materials or former/present activities and to assess the potential for corrosion and/or chemical attack.

2 SITE AND SUBSURFACE CONDITIONS

2.1 SITE LOCATION AND DESCRIPTION

The additions are located at 7224 Broadway Avenue in Cleveland Township, Cuyahoga County, Ohio. The overall property to be developed is bordered by Fleet Avenue to the south-east, Broadway Avenue to the north-east, and the Cleveland Public Library to the west and north-west. In the report Appendix, the soil boring locations are shown on the provided site layout plan. Based on publicly available historical aerial photos available on Google Earth and other public platforms, the site is occupied by the existing Cleveland Public Library. Presently, the proposed addition areas are covered mostly by grass, though the area of the vestibule addition does contain a concrete walking path.

Based on available topographic information from Google Earth Pro, the overall site surface is relatively flat. The grade difference within the footprint of these additions is approximately Elev. 723 ft. to 724 ft. The coordinates of the approximate center of the site are 41.456985, -81.637961. Surface drainage conditions appeared to be generally fair at the time (November, 2025) and locations of our field drilling operations.

It should be noted that the foregoing discussions regarding the site conditions are only provided for informational purposes since PSI's scope of services for this geotechnical investigation did not include performing an environmental site assessment (ESA) or a detailed review of the developmental history and former uses of the site. In addition, approximate elevations are used in the publicly available historical images posted on Google Earth and other electronic platforms which may include some time gaps and unclear images. Therefore, the foregoing information should not be exclusively relied on to establish the developmental history of the site and its former uses or the present surface grades which should be based on more precise means and examination of official records. This is beyond our geotechnical scope of services.

2.2 SITE SOIL SURVEY & GEOLOGY MAPPING BACKGROUND

Based on the USDA Web Soil Survey website (Web Soil Survey – Home), the following map unit is indicated across the proposed development area.

- **Loudonville-Urban Land Complex, rolling (LuC)** : This soil complex composition consists of 35 percent Urban Land (altered/obscured soils by human development), 50 percent Loudonville and similar soils, 15 percent minor components. The parent material for the Loudonville soils is indicated to be "loamy till" typically found on landforms indicated to be "ridges", the landform position being "side slope". For the Loudonville soils, the typical USCS classifications for the vertical extent of the soil survey (60 inches below natural/original grades) include silt loam, channery silt loam, and unweathered bedrock

Based on online Ohio Department of Natural Resources Geology Interactive Map (Ohio Geology Interactive Map), the project site is mapped as being underlain by two surficial geology units including Lacustrine san. The surficial deposits are underlain by the Ohio Shale formation which is described as brownish black to greenish gray (weathers to brown) carbonaceous shale with carbonite/siderite concretions. Based on ODNR bedrock contour information (50-foot contour intervals), the interpolated bedrock elevation is estimated to be around EL 625 feet.

2.3 GEOTECHNICAL FIELD EXPLORATION

PSI conducted a geotechnical exploration program at the site in conformance with generally accepted geotechnical engineering practices to provide subsurface information about the site. This information was utilized to develop geotechnical analysis for members of the design team for use on this project.

The subsurface exploration program consisted of the performance of Standard Penetration Test (SPT) borings to assess the depth and characteristics of the underlying material. The exploration locations were selected and marked in the field by PSI personnel and Ohio811 was notified for public utility clearance prior to performing the explorations at the site.

PSI drilled three (3) soil test borings to depths of approximately 24 feet below the existing surface grades (bsg). The boring locations are shown in **Figure 1: *Boring Location Plan.*** The locations for the test borings were selected by Client and located in the field by PSI personnel. PSI field personnel marked the boring locations using the furnished preliminary site plan showing the general boring locations relative to existing site features, a measuring wheel, and a handheld recreational grade GPS unit.

The soil test borings were advanced utilizing 3¼ inch inside diameter, hollow-stem auger drilling methods using a truck mounted CME-55 drill rig. Soil samples were obtained at 2.5-foot intervals to a depth of 10 feet followed by 5-foot intervals to the auger refusal or maximum depth explored of the borings. During the test boring sampling procedure, the Standard Penetration Test (SPT) was performed at regular intervals to obtain the SPT resistance (N-value) of the soil. The N-value is defined as the number of blows ("blow counts") of a 140-pound hammer free falling 30 inches, required to advance the split-spoon sampler 1 foot into the soil at each sampling increment. The 18-inch sampler is lowered to the bottom of the drill hole and the number of blows recorded for each of 3 successive increments of 6-inch penetration. The N-value is obtained by adding the second and third incremental blow count results. The results of the SPT indicate the relative density and comparative consistency of the soils and thereby provide a basis for estimating the relative strength and compressibility of the soil profile constituents. Selected soil samples were later tested in the laboratory to obtain soil material properties for the foundation recommendations. When practical auger/SPT split-spoon refusal occurred in relatively intact Bedrock, a 2-inch inside diameter NQ barrel was used to obtain representative rock cores. The percent recovery (Rec) and Rock Quality Designation (RQD) of each drilled intact rock core run were recorded and documented with photographs. Drilling, sampling, and laboratory testing were performed in general accordance with the applicable ASTM standard procedures.

2.4 GEOTECHNICAL SUBSURFACE CONDITIONS

The subsurface materials encountered at the test boring locations have been visually classified in general accordance with the Unified Soil Classification System (USCS/ASTM). Results of the visual classifications, Standard Penetration Test (SPT), natural moisture content tests, grain size tests, Atterberg Limits tests, and groundwater level observations are presented on the Boring Logs given in the ***Appendix*** of this report. Representative samples of the soil were placed in sample jars and are presently stored in our laboratory for further analysis, if requested. Unless the Client requests otherwise, PSI will dispose of all samples after 60 days following the date of issuance of this report.

The following paragraphs summarize the subsurface conditions encountered at the boring locations at the time of our field activities.

2.4.1 SURFACE COVER

The existing ground surface ranged from EL 723 ft to 724 ft MSL. for the respective boring locations. Ground surface conditions in the footprint of the additions consisted of approximately 5 to 12 inches of top soil in the selected boring locations. One concrete core was performed within the entryway of the existing building. The elevation of the existing building floor is EL 723 ft MSL.. This core consisted of 5.25 inches of concrete. Underlying this pavement was at least 6 inches of well-graded sand with clay and gravel base material.

2.4.2 EXISTING FILL/POSSIBLE FILL MATERIALS

The surface cover at test boring location B-1 was underlain by miscellaneous existing FILL materials that extended down to a depth of approximately 9.5 feet below the existing surface grades (bsg), (EL. 713.5 feet). The existing fill materials at B-1 consisted primarily of Silty Clayey Sand. At B-2, these fill materials extended down to a depth of approximately 13.5 feet (EL. 709.5 feet) and consisted of Sandy Lean Clay with Gravel and Poorly Graded Sand with various amounts of Gravel. At B-3 fill material was found to extend to a depth of 13.5 feet (EL. 709.5 feet) and consisted of Well Graded Sand with Clay and Poorly Graded Sand. The tested samples of the existing fill/materials exhibited a moisture content of 7 to 23 percent. The SPT N-Value results indicated a consistency of very loose to dense soils, with these values ranging from 3 to 36.

It should be noted that the Standard Penetration Test (SPT) may yield unrepresentative N-values in existing fill materials due to their heterogeneous character and undocumented placement conditions. In addition, the composition, depth interval, lateral extent, and engineering characteristics, such as strength and compressibility, of the existing fill materials should be expected to vary throughout the construction area. Other types of fill materials and/or debris may be present within the unexplored areas.

2.4.3 NATIVE SOILS AND BEDROCK

Underlying the existing fill materials in all test boring locations, native soils were encountered and extended down to bedrock depths of the borings, approximately 18.5 feet below the existing ground surface.

Based on the results of visual classification and select laboratory testing, the soils were classified as Poorly Graded Sand with Clay (SP-SC), and Lean Clay (CL**)** in general accordance with the Unified Soil Classification System (USCS). The standard penetration N-values of the soils generally indicate consistencies of loose to medium dense (SPT N-Values between 5 and 28). The natural in situ moisture contents of the soils ranged from approximately 5 to 14 percent.

Highly weathered shale bedrock was encountered at each boring location at a depth of approximately 18.5 feet bsg (EL.704.5 ft MSL.). At boring B-2, the hollow-stem augers were able to penetrate this shale rock interval to a depth of 23.7 feet bsg.(EL. 699.3 ft MSL.). At borings B-1 and B-3, rock coring was began just beneath the shale encounter depth of 18.5 feet bsg. A single 5 foot run was completed at both of these two boring locations. At B-1, this run began at a depth of 19 feet bsg and extended to a depth of 24 feet bsg (EL. 704 to EL. 699 MSL). A sample of the top portion of the shale was taken with a split spoon, the SPT-N Value for this sample was 50/1”. This rock core had a recovery of 89 percent and an RQD value of 0%. The second rock core was taken at the bottom of B-3. A spoon sample was taken at the top of the shale layer at this location as well, with an SPT-N Value of 50/2”. The run at this location began at 19.5 feet bsg and extended to a depth of 24.5 feet bsg (EL. 703.5 to EL. 698.5). The B-3 rock core showed a recovery of 80 percent and an RQD value of 0%.

2.5 GROUNDWATER LEVEL MEASUREMENTS

Free water and short-term groundwater were observed and measured at the exploration boreholes during and immediately after completion of the drilling activities. As previously discussed, the existing surface grades at the soil boring locations drilled within the proposed project site varied between about EL 723 ft to 724 ft. **Table 2.3-T1** summarizes the groundwater information encountered during the exploration.

Table 2.3-T1: Ground Surface and Groundwater Information

Project Design Element	Test Boring ID (GS)[1]	Approx. Groundwater Depth Below Existing Ground Surface (feet)			
		During Drilling	After Drilling	Water Introduced	Cave Depth
Proposed Vestibule Addition	B-1 (EL. 723 ft.)	10 (EL. 713 ft.)	8 (EL. 715 ft.)	19 (EL. 723 ft.)	N/E[2]
	B-2 (EL. 723 ft.)	13 (EL. 710 ft.)	N/E[2]	N/E[2]	19 (EL. 704 ft.)
Proposed Storage, Study, and Innovation Room Addition	B-3 (EL. 723 ft.)	8.5 (EL. 714.5 ft.)	N/E[2]	19.5 (EL. 703.5 ft.)	N/E[2]

[1] Surface elevations are estimated from Google Earth Pro and should be considered approximate.
[2] Not encountered.

It should be noted that groundwater level fluctuates seasonally as a function of rainfall, snowmelt, prolonged drought periods, and ambient conditions as well as water levels in any nearby water bodies. The water level of Lake Erie will impact the groundwater level at the site. During a time of year or weather different from the time of drilling, there may be considerable change in the water table elevation. Furthermore, the water level in a borehole is often not representative of the actual groundwater level, because it remains open for a relatively short period.

PSI recommends that the Contractor determine the prevailing groundwater level at the time of construction to evaluate its impact on the construction activities. Consideration could be given to monitoring groundwater levels with piezometers or observation wells particularly if relatively deep excavations that remain open for an extended period are anticipated. This is extremely important considering the vicinity of the proposed construction to existing sensitive structures and streets in addition to the potential for expecting a perched water condition within parts of the site.

3 GEOTECHNICAL EVALUATIONS AND RECOMMENDATIONS

3.1 GEOTECHNICAL EVALUATION

The purpose of our geotechnical services was to assess the subsurface conditions at representative and readily accessible locations designated by Cleveland Public Library within the limits of the project site and develop geotechnical related recommendations and parameters for possible use by others in the design of a suitable foundation system for the proposed building and the associated pavement improvement along with general guidance pertaining to site preparation, fill placement, and other related construction activities. Our scope for this geotechnical study included a reconnaissance of the project site, drilling and sampling at a total of three (3) test borings to evaluate the subsurface conditions within the areas of the project design elements, completing a laboratory testing program, and submitting the results or our geotechnical engineering analysis and evaluation of the surface materials encountered at the time and locations of our field exploration.

Soil borings B-1, B-2, and B-3 were drilled within the footprint of the proposed additions where the existing ground surface is relatively flat with a grade difference of about 1 feet (from about EL 723 ft to 724 ft). PSI anticipates the FFE of the proposed building additions will match the FFE of the existing building, approximately EL 723 feet. The frost line within the general geographical area of the project site is located at about 3.5 foot depth below the surrounding exterior surface grades. Therefore, the frost line will be at about EL. 719.5 feet. **Table 3.1-T1** summarizes the conditions encountered at the boring locations which could impact the proposed development on the subject site.

Table 3.1-T1: Field Exploration & Construction Details

Design Element	Boring ID	Approx. GS[1] Elev. (feet)	Boring Depth (feet)	Near Surface Native Soil Interval
Proposed Vestibule Addition	**B-1**	723	24 (Elev. 699)	Very Loose, Wet, Brown, Poorly-graded SAND with CLAY (SP-SC)
	B-2	723	23.7 (Elev. 699.3)	Very Stiff, Moist, Brown-Gray, Lean CLAY (CL)
Proposed Storage, Study, and Innovation Room Addition	**B-3**	723	24.5 (Elev. 698.5)	Medium Stiff, Moist, Brown-Gray, Lean CLAY (CL)

[1] Surface elevations are estimated from Google Earth Pro and should be considered approximate.
[2] Based on building FFE at Elev. 723 ft.
[3] Soil subgrade elevation based on an FFE at Elev. 723 ft. and frost line at Elev. 719.5 ft.

Based on the results of the soil borings and laboratory tests summarized in the previous sections and **Table 3.1-T1**:

1. The existing ground surface at the proposed addition locations (B-1, B-2 and B-3) is presently at about EL 723 ft to 724 ft. The frost line within the general geographical area of the subject parcel is located at about 3½-foot depth below the finished exterior surface grades. The Finished Floor Elevation (FFE) was not available at the time of report submittal. The Finished Floor Elevation (FFE) of the proposed building additions is estimated to be El. 723 feet. Therefore, all exterior perimeter footings of the proposed

building additions, and any associated lightly loaded ancillary structures, should bear no shallower than El. 699.5 feet.

2. Existing/Prior Construction: The site is developed with existing structures and associated pavements and underground utilities. Therefore, the potential exists at the site for remnant underground construction or unsuitable fill conditions. PSI recommends that below grade construction for existing or former structures and unsuitable/unstable fill materials be removed (e.g., walls, foundations, slabs, and utilities to be abandoned). Excavations created as a result of removal of existing elements should be backfilled with structural fill in accordance with this report.
3. Undocumented Fill: Existing fill materials were noted in all test boring locations, extending to depths of 9.5 to 13.5 feet below existing grade. The potential exists for fill materials to be present elsewhere within the development limits. No documentation of the placement of the fill was provided. There are inherent risks for conventional foundations and grade supported slabs on sites containing undocumented fill. Due to the potential variability and potential for deleterious materials, there exists a higher risk of unacceptable settlement of foundations, floor slabs, and pavement systems constructed on these undocumented fills. Unstable or unsuitable (e.g., organic or debris-laden, or large hard obstructions) fill soils should be completely removed and replaced with structural fill. At the time of construction, the exposed fill conditions should be observed by PSI and field conditions will dictate the need or extent of remedial measures to address pre-existing fill materials.
4. Very Loose Relative Density Sands: Based on the results of PSI's test borings, the boring B-1 consisted of sandy soils often in a loose relative density condition based on the SPT N-values. If unstable subgrades are exposed during construction, then compacted in-place, scarification (dry-back) and recompaction, stabilization (e.g., geogrid, geotextile, cement treatment) or removal/replacement of unstable subgrades during earthwork is required prior to floor slab, pavement, and foundation construction.
5. The near surface native soils encountered at the boring locations are sensitive and susceptible to experiencing a loss in shear strength and instability when the become disturbed or excessively moist. Therefore, positive drainage collection, discharge and disposal of surface water and rainwater runoff should be established throughout the construction area. This should be maintained during construction and the design service life of the proposed project. Sufficient measures should be taken to minimize disturbance of the near surface soils during construction.
6. In view of ***Items*** above, any exposed soil subgrade that exhibits low-strength (very loose to loose), poor in quality (undocumented existing fill), excessively moist, destabilized, or otherwise disturbed during subgrade preparation within the building and pavement improvement areas should be fully excavated and replaced with good-quality controlled-compacted structural fill as needed to achieve the design grades as will be discussed in ***Sections 3.2 and 3.3***. Additionally, aeration and drying of the soils may be required during site grading, fill placement and compaction activities. If site grading, fill placement and compaction activities take place during the wet or cold season of the year, lime stabilization (or other forms of chemical modification) may be necessary to expedite site grading and achieve the required level of soil compaction in cohesive soils (CL).

7. Induced Settlements: New footings adjacent to the existing building should be placed at the same elevation as the existing soil bearing foundations. Where new foundations are located in close horizontal and vertical proximity to existing foundations, the new foundations will increase the stresses in the soil beneath the existing foundations. This creates the potential for new settlement of the existing foundations. Differential settlement between the new and existing construction should be anticipated. Construction joints should be provided between the existing building and the additions. Additional settlements from the existing footings can be anticipated if new footings are constructed within a lateral distance of two times the footing width.

8. Undermining of Existing Structures: Due to the loose soils encountered during the field exploration, undercuts should be anticipated during foundation construction. During the undercutting for foundations, the existing building should not be undermined. It is possible for undercut excavations to extend below existing foundation levels. Properly designed shoring and bracing or underpinning (e.g., helical piles) should be utilized as necessary to adequately protect the existing building, utilities, pavements, and other structures. Bracing or underpinning should be performed by an experienced specialty Contractor. Care should be used during installation of any bracing system, especially those using driven or vibratory methods, in order to avoid damage to the existing building, utilities or existing structures.

In light of our test borings and proposed construction, the underlying very loose native soils may need to be compacted in place or partially removed and replaced (provided existing foundations are not undermined) as field conditions dictate and as determined by PSI. In lieu of mass excavation or densification of the in-situ soils, alternative foundation systems or ground improvement methods may be used for support of the structures. The foundations may be supported on helical piers, micropiles, or ground improvements such as Rammed Aggregate Piers (RAP), Vibrated Stone Columns (VSC), or Controlled Modulus Columns. PSI recommends that these systems are designed and installed by a qualified vendor and/or contractor.

3.2 SITE PREPARATION AND EARTHWORK CONSTRUCTION

It is our opinion that the means, methods, and sequence of the proposed construction, including site preparation and site and personnel safety, should be the responsibility of the Contractor, who should specialize in this type of work. However, general geotechnical related guidelines are offered herein in this regard for possible consideration during construction. Prior to commencing construction, good and positive drainage, collection, discharge and disposal of surface water and rainwater runoff should be established throughout the construction area and should be maintained throughout the construction period and the design life of the project. The construction drainage plan should account for the site topography, drainage patterns within the geographical area, required cut and fill operations, presence of miscellaneous fill materials, groundwater level, perched water, site access, and ambient conditions at the time of construction.

Prior to placing pavement sections, concrete floors or structural fill on this site, general site area clearing should be carried out. All organic matter, existing pavement sections, buried structural elements, demolition debris, deleterious and objectionable materials, and utilities; along with any weak soils or obviously compressible subgrade materials should be fully removed from the proposed construction area. Any unsuitable or compressible materials encountered within the building footprint, such as the medium dense FILL material at boring location B-05 or very loose to loose sandy soils encountered throughout the proposed building addition, should be fully removed, bypassed, or compacted/densified in-place, and to a depth of at least 18 inches below the underside of the pavement section or a floor slab of a lightly-loaded ancillary structure and backfilled with good-quality controlled compacted structural fill. The prepared subgrade should be inspected, sufficiently compacted to achieve at least medium dense relative density and thoroughly tested (i.e., proof-roll, moisture/density, etc.) to assure its uniformity and competence throughout the entire footprint of the proposed building and access driveway areas.

A PSI representative should observe the various potential subgrade conditions and field conditions will dictate the actual need or extent of remedial measures to address foundation, slab-on-grade, and pavement subgrades. The remedial measures may include compaction in-place, scarify (dry-back) and recompact, stabilization (e.g., geogrid, geotextile, cement) or removal/replacement of unstable subgrades during earthwork, floor slab, pavement, and foundation construction.

The precise depth of required cut and fill or other remedial measures should be determined in the field by a representative of PSI following observation of the exposed subgrades and proof-roll testing operations. Therefore, it is recommended that exploration test pits be made with a backhoe or other similar equipment to better delineate the character, depth, and lateral extent of the near surface existing fill materials and any underlying weak native soils within the footprints of the proposed project design elements. This type of field exploration would better determine the depth, areal extent and character of the near surface soils and aid in determining the depth of the required shallow excavations and replacement of poor quality near surface debris, deleterious and objectionable materials, existing fill materials, organic matter, weak native soils, etc. Exploration test pits could be performed with a backhoe or other similar equipment to better delineate the character, depth, and lateral extent of the near surface materials to be removed within the entire footprint of a project design element.

Following site clearing, stripping, and undercutting, and prior to placing structural fill, the soil subgrade be proof-compacted with a 15-ton smooth drum vibratory roller under the observation of a PSI representative to expose soft/loose subgrade areas and to determine extent of any necessary undercuts or need for other remedial measures.

Prior to placement of aggregate stone base for pavements and slab-on-grades and prior to paving and slab-on-grade construction, the exposed subgrade should be critically proof-roll tested with a loaded 20-ton tandem-axle dump truck until the grade offers a relatively unyielding or pumping surface. Areas of excessive yielding or pumping, as observed by a PSI representative, should be excavated down to a stable material, removed, and backfilled with compacted structural fill and/or the unstable soils in the areas of lightly-loaded ancillary structures can be stabilized by choking the exposed bearing surface with crushed limestone or similar coarse aggregate. After the existing subgrade materials have been excavated to the design grade or over-excavated to well-drained, firm, and stable subgrade, proper control of subgrade competence and the placement and compaction of new fill materials should be observed and tested by a representative of PSI.

All excavations should be backfilled with good-quality controlled-compacted structural fill which should also be used to achieve the design grades within the areas of soil-supported footings and floor slabs. Tested fill materials that do not achieve either the required dry density or moisture content range shall be recorded, the location noted and reported to the Contractor and Owner. A re-test of that area should be completed after the Contractor performs remedial measures.

It is recommended that the site preparation, proof-roll testing, and earthwork activities should be performed during a period of dry weather with good and positive drainage, collection, discharge, and disposal of surface water and runoff rainwater established throughout the construction area, which can significantly reduce the extent of the required soil stabilization, drainage, and surface repairs.

During site preparation, former structural elements, abandoned utility lines, debris, large rock fragments, burn pits, trash pits or other isolated disposal areas may be encountered. All too frequently, such buried material occurs in isolated areas outside boring locations. Any such material encountered during site work, foundation, or floor slab construction should be excavated, removed from the site, and backfilled with controlled-compacted structural fill material, good-quality controlled-compacted crushed stone aggregate, controlled low strength flowable fill material (CLSM), lean concrete, or controlled-compacted structural fill material depending on the depth of the excavation, bearing subgrade material type, and the proposed construction within the subject area.

3.3 STRUCTURAL FILL

The type, quality, and placement conditions of all fill and bedding materials shall conform to the requirements stated in the project specifications as well as those of the applicable building codes, local municipalities, and other regulatory agencies. Good-quality materials selected for use as structural fill should not contain more than 5 percent by weight of organic matter, waste construction debris, or other deleterious or objectionable materials. The replacement and site grading material could consist of either good-quality controlled-compacted structural fill, good-quality controlled-compacted crushed stone aggregate, flowable fill material (CLSM), or 2,000 psi lean concrete depending on the selected option in the foundation design. Fill materials should have a maximum dry density of at least 110 pounds per cubic foot (pcf) as determined by a Standard Proctor (ASTM D-698), an Atterberg Liquid Limit of less than 40, a Plasticity Index of less than 15, and a maximum particle size of 3 inches or less.

Structural fill should consist of non-expansive materials. Pyritic and/or potentially expansive materials, such as mine tailings, slag, shale fragments and soil mixed with more than 5 percent of shale fragments, should not be used as structural fill material. In any case, all fill and bedding materials should conform with the requirements of the applicable building codes and those of the local municipalities and other governing regulatory agencies.

Based on the results of the borings, the native granular soils are suitable for reuse as structural fill. However, if the onsite soils are used for fill, close moisture content control will be required to achieve the recommended degree of compaction. PSI anticipates that disking and aerating the soils during a warm, dry period may be necessary to lower the moisture content. If structural fill placement must proceed during a wet or cool time of the year, it may likely be infeasible to re-use the on-site soils as structural fill and imported fill materials would be required. If wet or cool season earthwork is necessary, we recommend the use of imported fill materials such as ODOT #304 crushed aggregate.

Representative samples of the proposed backfill materials should be collected at least one week prior to the start of the filling operations. The samples should be tested to determine the maximum dry density, optimum moisture content, particle size distribution and plasticity characteristics. These tests are needed to determine if the material is acceptable as structural fill and for quality control during the compaction process.

Fill materials should be placed and compacted in individual lifts of 8 inches or less loose measurement. Within small excavations such as in utility trenches, around manholes, or behind retaining walls, we recommend the use of smaller, hand- or remote-guided equipment. Loose lift thicknesses of 4 inches or less are recommended when using such equipment.

A representative of PSI should observe fill placement operations and perform density tests concurrently to indicate if the specified compaction is being achieved. We recommend that the structural fill be evaluated in accordance with the following table:

MATERIAL TESTED	PROCTOR TYPE	MINIMUM % DRY DENSITY	PLACEMENT MOISTURE CONTENT RANGE*[1]	FREQUENCY OF TESTING
Structural Cohesive Fill	Standard*[3]	98%	-1 to +3 %	1 per 2,500 sq ft / lift[2]
Structural Granular Fill	Standard*[3]	98%	-2 to +2 %	1 per 2,500 sq ft / lift[2]
Utility Trench Backfill	Standard*[3]	98%	-2 to +3 %	1 per 150 lineal sq ft. / lift[2]

*[1] Moisture range relative to the soil's optimum moisture content

*[2] Minimum 2 per lift.
*[3] Per ASTM D-698.

Tested fill materials that do not achieve either the required dry density or moisture content range shall be recorded, the location noted and reported to the Contractor and Owner. A re-test of that area should be performed after the Contractor performs remedial measures.

3.4 EXISTING UTILITIES

Some underground utility lines may also be present in the proposed construction area which could pose some potential concerns including:

- Possible interference with a structural foundation
- A pipeline could form a conduit for water to migrate or flow under and/or around a structure foundation, particularly if cracked.
- Future deformation or collapse of the pipeline could result in differential or localized settlement within its vicinity.
- Future excavations to remove a pipeline could impact a constructed structure foundation

In view of the foregoing concerns and the former and presence uses of the site, effort should be made to determine the alignment and conditions of all existing below grade structures either via site inspections, examination of public records or nondestructive methods, such as Ground Penetrating Radar (GPR) prior to commencing construction. Once a below grade structure is detected, its alignment should be checked for any possible conflict with the proposed construction. If such conflict exists, the below grade structure within the conflict area should be abandoned, excavated, removed, and backfilled with compacted structural fill material as per the project specifications. Alternatively, a given pipeline segment could be filled (i.e., plugged) with grout to minimize the potential for future ground settlement in case it does deteriorate or collapse with time. Plugging or removing the pipeline would eliminate the potential for water flow or migration into a structure foundation area and into the areas where near surface swelling soils exist. Regarding any water well or septic tank well, it should be plugged and abandoned in accordance with the requirements of the applicable building code and/or governing municipality.

3.5 FOUNDATION RECOMMENDATIONS

3.5.1 SUBSURFACE CONDITIONS SUMMARY

Based on the results of borings B-1, B-2, B-3, subsurface conditions at the project site generally consist of **near-surface** fill underlain by natural sands, lean clays, and ultimately **weathered shale** at depths of approximately **18 to 25 feet** below existing site grades.

Present fill extends to depths of approximately **5 to 12 feet bsg** and generally consists of moist, brown, poorly-graded SAND with variable silty, clayey, and gravelly content. Below the fill, natural soils consist of **very loose to medium dense poorly-graded SAND**, followed by zones of **medium stiff to very stiff Lean CLAY (CL).** Weathered Shale was encountered in all borings between depths of approximately **18 and 25 feet bsg**, with some intervals being described as very fine-grained and of **poor to very poor rock quality** (as indicated by core recovery and RQD values). Groundwater was also observed during drilling operations; groundwater levels are expected to fluctuate seasonally and should be monitored during construction.

The variable nature of the near-surface fill and the presence of loose granular soils make the use of conventional shallow foundations less desirable without significant subgrade improvement. The presence of shale within a reasonable depth provides an ideal bearing stratum for deep foundations.

3.5.2 RECOMMENDED FOUNDATION SYSTEM

Based on the proposed building loads and subsurface conditions, **drilled piers (caissons) bearing in weathered shale** are recommended as the **primary foundation system** for the proposed additions. This recommendation is consistent with the project's anticipated foundation plan and provides improved performance compared to shallow foundations, particularly in regard to settlement control and reliability beneath masonry-bearing walls and column loads of up to **100 kips**.

3.5.3 DRILLED PIER FOUNDATIONS

Drilled pier foundations are recommended for support of the proposed additions and for supplemental support of existing structures where required. The recommendations provided below are based on the subsurface conditions encountered in borings B-1, B-2, B-3, including rock coring performed at borings B-1 and B-3.

The upper soils consist of fill and loose to medium dense sands, underlain by Lean CLAY (CL) extending to depths of approximately 18 feet. Rock coring conducted between depths of approximately **19 to 25 feet** encountered shale with core recoveries ranging from approximately **80 to 89 %** and Rock Quality Designation (RQD) values of **0 percent**. The shale is therefore classified as very poor quality, highly fractured, and weathered. As a result, the shale was not considered competent for development of rock socket resistance or rock end bearing. Drilled Piers should be designed as soil-supported elements deriving axial capacity from side resistance within the underlying Lean CLAY soils and limited end bearing in stiff clay immediately above the shale.

Drilled pier design was evaluated using undrained clay parameters appropriate for the lean clay soils encountered. The following parameters were used for design:

- Undrained shear strength of lean clay, su: **1,000 psf**
- Adhesion factor, α: **0.45**
- Unit side resistance, fs=αsu: **450 psf**
- Unit bearing factor in clay, Nc: **6**
- Unit end bearing in clay, qb=Ncsu: **6,000 psf**

Rock socket resistance and rock end bearing were not included in the evaluation due to the very poor rock quality indicated by RQD values of **0 percent.**

New drilled piers may be designed for axial compression loads using a minimum factor of safety of **2.5**. For preliminary design, a **36-inch-diameter** drilled pier with approximately **20 feet of embedment** and bearing in stiff clay immediately above the shale may be designed for an allowable axial load on the order of **40 to 45 kips**. Allowable axial capacity for other pier diameters may be interpolated based on similar embedment conditions

Axial settlement of drilled piers designed in accordance with these recommendations is expected to be small and within tolerable limits for typical building structures. Based on experience with similar Lean CLAY soils and the

applied service-level loads, the total axial settlement for new drilled piers will be less than **½ inch**. For existing drilled piers subjected to additional axial loading the incremental settlement is expected to be less than **¼ inch.**

Differential settlement between adjacent drilled piers supporting similar loads is expected to be less than ¼ inches, provided pier diameters, embedment depths, and loading conditions are relatively uniform.

Existing drilled piers that are in satisfactory condition and bearing in the same soil strata may be designed to support additional axial load. Because these foundations are preloaded and have already undergone primary consolidation, a higher allowable capacity may be used for incremental loading only. For preliminary design, a **36-inch-diameter** existing drilled pier may be designed for an additional allowable axial load of approximately **50 to 55 kips**, provided no evidence of distress is observed.

Drilled per excavations should extend through fill and loose surface soils and be founded in undisturbed Lean CLAY. The pier base should be cleaned of loose or softened material prior to concrete placement. Temporary casing or slurry may be required to maintain excavation stability. Concrete should be placed promptly after excavation, and reinforcement should be installed in accordance with the structural design.

The recommendations provided herein are based on the subsurface conditions encountered at the boring locations and may require adjustment if different conditions are observed during construction.

3.5.4 OPTION 2: SHALLOW FOUNDATIONS

Conventional spread footings may be considered **only** if the structural significant fill and loose granular soils are **completely undercut and replaced** with compacted engineered fill or if improved ground is provided. This option is **not preferred** due to the variable fill thickness (up to 13.5 feet), loose or very loose sands beneath the fill, presence of soft to medium stiff clays prior to reaching competent shale, and unpredictable settlement behavior. If shallow foundations are pursued, allowable bearing pressures should be based on improved subgrade conditions, typically **3,000 psf** for preliminary use, and settlement analyses must be performed.

Slab-on-grade areas should be supported on **proofrolled** natural subgrade or **engineered fill**. Any soft, loose, or excessively wet soils should be undercut and replaced. Fill supporting slabs should consist of **compact granular material** meeting project specifications.

New shallow foundations should be founded in undisturbed lean clay soils below existing fill and loose sand. Based on subsurface conditions encountered and laboratory testing, a net allowable bearing pressure of **1,500 psf** may be used for design of new foundations.

Existing foundations supporting additional load may be designed using a net allowable bearing pressure of **2,000 psf** for incremental loading, provided the foundations bear on the same soil stratum and are observed to be in satisfactory condition with no evidence of distress.

Although no high-plasticity CLAY (CH) was observed in the borings, portions of the Lean CLAY (CL) may exhibit moderate plasticity and moisture sensitivity. For pavement areas, unsuitable fill or soft clay to depths of 12 to 24 inches below subgrade must be removed and replaced with compacted granular fill or aggregate base. Appropriate drainage and separation geotextile where fine-grained or wet soils are present must be provided.

3.5.5 GENERAL FOUNDATION RECOMMENDATIONS

Footing bearing surfaces are to be critically inspected and tested to verify consistency and compatibility with subsurface exploration data, and to assure that the recommended bearing capacity is being achieved. Extremely moist, weak, unstable, or highly disturbed native soils encountered within the area of the foundation system should be either removed and replaced with good-quality controlled-compacted structural fill or bypassed by the foundation elements. It is recommended that a representative of the Geotechnical Engineer be present at the site throughout foundation excavation and construction.

Extreme care should be taken to prevent weakening of the foundation bearing materials resulting from prolonged atmospheric exposure, construction activity disturbance, or an increase in moisture content. In the event an overnight delay in concrete placement is anticipated, the foundation excavations should terminate approximately 6 inches above final grade and subsequently excavated to final grade immediately before placement of concrete.

PSI should be retained to provide observation and testing of construction activities related to structure foundation, earthwork, and related aspects of this project. PSI cannot accept responsibility for conditions that deviate from those described in this report, nor for the performance and testing for this project.

3.5.6 PROTECTION OF EXISTING FOUNDATIONS/FLOOR SLABS

Care should be exercised not to undermine the existing building foundations or floor slabs. Excavations for new footings should not extend beyond a line extending from the bottom outer edge of existing footings or floor slabs outward and downward and inclined at 45 degrees. It may be necessary to underpin any existing shallow foundations or floor slabs if this zone is encroached for any necessary excavations near existing structures. In addition, new foundations should not extend into a zone established by a similar 45-degree projection both above and below the edge of existing foundations. In any case, excavations below existing foundations should not be permitted without consultation of the structural engineer and PSI Geotechnical Engineer.

The addition should be structurally separated from the existing building and expansion joints provided. Foundations move or settle proportional to the amount of the load that they transfer to the underlying bearing soils. Where new foundations are located in close horizontal and vertical proximity to existing foundations, the new foundation will increase the stresses in the soil beneath the existing foundation, potentially leading to new settlement of the existing foundation. If specific foundation locations/sizes (existing/proposed), and specific new foundation loadings are provided, PSI can evaluate the potential displacement of existing foundations, if desired. Furthermore, PSI recommends that when the final design is completed, a PSI geotechnical engineer should review the foundation and grading plans along with any underpinning plans, if required.

3.6 UPLIFT RESISTANCE

Provisions should be made in the design of the building and any outdoor canopy or walkway to account for the anticipated cases of tension or upward loads acting on its individual columns/footings as determined by the Structural Engineer. Uplift Wind Load is the upwards force of wind that affects roof structures or similar horizontal elements of a building, such as canopies or awnings. Wind flowing under a roof pushes it upwards while wind flowing over a horizontal structure pulls the roof upwards. In addition, provisions should be made for sufficient resistance against upward uplift pressure due to the unbalanced or differential water head between external water or groundwater level and water level below a floor or base slab, footing, or an underground structure. Resistance to vertical upward forces and water uplift pressure is provided by self-weight of the

concrete elements, sustained structural compression or downward loads for the case under consideration, and self-weight of the soils placed directly above the top or roof of a below grade structure or an individual footing, together with any tension piles or anchors, if deemed necessary. The Maintenance Case of an empty fully constructed below grade structure is more critical under service loads, and the Construction Case of an empty structure prior to the placement of any backfill material over and around the structure are the most critical.

For a spread footing bearing below the surface grades for the design conditions being analyzed, PSI recommends using a total, or 'moist', unit weight (γ) of 120 lbs. per cubic foot (pcf) for compacted structural fill and a total unit weight (γ) of 150 pcf for reinforced concrete elements. The total unit weights should be used to evaluate stability against water uplift pressure. In the case of a spread footing or structural element subjected to an external upward (tension) load, the buoyant unit weights for the backfill and concrete materials should be used to evaluate stability. If believed probable at the subject site, a flood condition with water level being at or above the ground surface will represent the most critical scenario in terms of differential head and uplift pressure acting on the underside of the footing. No transient resisting structural loads should be considered in the uplift pressure, or upward load analysis that may not prevail under the extreme design condition being analyzed (i.e., flood case, design wind load, etc.). In addition, the shear resistance mobilized along the potential theoretical failure surface within the soil mass above the footing should be ignored.

If self-weight of concrete, sustained structural loads and self-weight of the backfill over the footing cannot overcome the uplift pressure, then consideration should be given to increasing the dimensions or geometry of the footing. Similarly, the footing could be extended by forming a "lip" underneath the perimeter backfill to provide additional resisting weight against upward uplift pressure. We recommend a factor of safety (FS) of 1.2 to 1.5 be used for design against uplift and upward loads depending on the criticality, duration, probability of occurrence, and associated risks of the case or loading conditions being analyzed.

3.7 OVERTURNING AND ECCENTRICITY

Provisions should be made in the structural design to accommodate the effects of all possible loading and moment combinations acting on the footings supporting the individual columns and walls of an above grade structure or a below grade structure. Above grade structures could be subjected to overturing moments, uplift loads due to wind, lateral loads, accidental vehicular impact, etc. Sufficient measures should be incorporated in the architectural and structural designs to account for and/or protect the columns of the above grade structure against accidental vehicular impact. Similarly, below grade structures could be subjected to overturing moments, uplift loads due to unbalanced water pressure, and lateral loads due to soil and groundwater pressures as well as any other surcharge and external loads. The magnitude and point of application of the design lateral loads, wind loads, water loads, etc. due to all anticipated cases of possible combinations of loads and moments should be determined by the Structural Engineer as per the wind, vehicle, other project design basis, and governing building codes.

It is recommended that the resultant of the applied load for all possible loading combinations be located within the middle-third of the footing to assure its full contact with the underlying soil subgrade producing exclusively compressive contact pressure. A factor of safety of 1.5 should be used to assure stability against overturning moments.

3.8 SEISMIC SITE CLASSIFICATION

The project site is located within a municipality that employs the 2024 Ohio Building Code based on the 2021 edition of the International Building Code with incorporated Ohio changes. As part of this code, the design of structures must consider dynamic forces resulting from seismic events. These forces are dependent upon the magnitude of the earthquake event as well as the properties of the soils that underlie the site. As part of the procedure to evaluate seismic forces, the code requires the evaluation of the Seismic Site Class, which categorizes the site based upon the characteristics of the subsurface profile within the upper 100 feet of the ground surface. To define the Site Class for this project, we have interpreted the results of the soil test borings drilled within the project site and estimated appropriate subsurface properties below the base of the borings to a depth of 100 feet as permitted by the code.

Based upon our evaluation, the subsurface conditions within the site are consistent with the characteristics of a **Site Class "D"** as defined by the IBC which references ASCE 7-16. The associated probabilistic ground acceleration values and site coefficients for the general site area were obtained from the OSHPD Seismic Desing Maps web page: https://www.seismicmaps.org/ The seismic values and coefficient are presented in Table 1 below:

Table 1: Ground Motion Values*

Period (sec)	Mapped MCE Spectral Response Acceleration** (g)		Site Coefficients		Adjusted MCE Spectral Response Acceleration (g)		Design Spectral Response Acceleration (g)	
0.2	S_S	0.144	F_a	1.6	S_{ms}	0.23	S_{Ds}	0.153
1.0	S_1	0.05	F_v	2.4	S_{m1}	0.119	S_{D1}	0.079

**2% Probability of Exceedance in 50 years for 41.45712090, -81.63805910*
***At B-C interface (i.e. top of bedrock)*
MCE = Maximum Considered Earthquake; g = acceleration due to gravity

If the Seismic Design Category, as determined from the intended building use and the IBC is interpreted to be C, D, E, or F, the code requires an assessment of slope stability, liquefaction, potential and surface rupture due to faulting or lateral spreading. Detailed evaluations of these factors were beyond the scope of our services.

3.9 FLOOR SLAB DESIGN AND CONSTRUCTION

The floor slabs of the buildings could be grade-supported on good-quality, controlled-compacted, low plasticity structural fill in areas where unstable, moist, highly disturbed, weak soils, of existing fill materials had to be removed. Proof-roll testing, as discussed earlier in this report, should be performed to identify soft or unstable soils that should be removed from the floor slab area prior to fill placement and construction of the floor slab. All objectionable materials should be replaced with good-quality controlled-compacted structural fill meeting the requirements listed in ***Sections 3.2 and 3.3*** of this report. PSI recommends that a minimum 6-inch thick free-draining granular material be placed beneath the floor slab to enhance drainage. The soil subgrade surface shall be graded to drain away from the structure without low spots that could entrap water prior to placing the granular drainage layer.

For a subgrade consisting of native granular soils or good-quality controlled-compacted structural fill prepared as recommended in this report, a modulus of subgrade reaction, *k* value, of 100 pounds per cubic inch (pci) may be used in the grade slab design based on correlation to values typically resulting from a 12-inch diameter plate load test. However, depending on how the slab load is applied, the value will have to be geometrically modified. The value should be adjusted for larger areas using the following expression for fine-grained and coarse-grained soil:

Modulus of Subgrade Reaction; $k_s = \left(\frac{k}{B}\right)$ for fine-grained soil and

$$k_s = k \left(\frac{B+1}{2B}\right)^2 \text{ for coarse-grained soil}$$

where: k_s = coefficient of vertical subgrade reaction for loaded area,
k = coefficient of vertical subgrade reaction for 1 square foot area, and
B = effective width of area loaded, in feet

The precautions listed below should be followed for construction of slab-on-grade pads. These details will not reduce the amount of movement but are intended to reduce potential damage should some settlement of the supporting subgrade take place. Some increase in moisture content is inevitable because of development and associated landscaping. However, extreme moisture content increases can be largely controlled by proper and responsible site drainage, building maintenance, and irrigation practices.

- Cracking of slab-on-grade concrete is normal and should be expected. Cracking can occur not only as a result of heaving or compression of the supporting soil, but also as a result of concrete curing stresses. The occurrence of concrete shrinkage cracking, and problems associated with concrete curing may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement, finishing, and curing, and by the placement of crack control joints at frequent intervals, particularly where re-entrant slab corners occur. PSI also recommends that the slab be independent of the foundation walls. Using fiber reinforcement in the concrete can also control shrinkage cracking.
- Areas supporting slabs should be properly moisture conditioned and compacted. Backfill in all interior and exterior utility line trenches should be properly compacted to reduce the shear stress in the concrete extending over these areas.
- The designer of the slab-on-grade concrete floor should consult the most current American Concrete Institute (ACI) guidelines/standards for concrete floor design.

Exterior slabs should be isolated from the structure, should not be structurally connected to the structure or foundation, and should be reinforced to function as independent units. Movement of these slabs should not be transmitted to the structure foundation or superstructure.

4 CONSTRUCTION CONSIDERATIONS

It is our opinion that the means, methods, and sequence of the proposed construction, including site preparation and site and personnel safety, should be the responsibility of the Contractor, who should specialize in this type of work. However, general geotechnical related guidelines are offered herein in this regard for guidance and possible consideration. Prior to proceeding with construction, good and positive drainage collection, discharge and disposal of surface water and rainwater runoff should be established throughout the construction area and should be maintained throughout the construction period and the design service life of the proposed addition. This is particularly important considering the presence of some near surface materials that are sensitive to changes in moisture content and can experience a loss in shear strength and bearing support and instability when disturbed or become excessively moist, especially during wet weather conditions.

It is recommended PSI be retained to provide observation and testing of construction activities involved in the foundations, earthwork, and related activities of this project. PSI cannot accept any responsibility for any conditions which deviated from those described in this report, nor for the performance of the foundations if not engaged to also provide construction observation and testing for this project.

4.1 GROUNDWATER CONTROL AND DRAINAGE

Groundwater was encountered at each of the test boring locations within the proposed building additions during field drilling operations as well as after completion of the field drilling activities. However, it should be noted that groundwater levels fluctuate seasonally as a function of rainfall. In addition, a perched water condition could also develop within some parts of the site when rainwater becomes entrapped within the pavement base layer or existing fill materials. In the event that groundwater seepage is encountered during foundation excavation and construction, a gravity drainage system, sump pump or other conventional dewatering procedure, as deemed necessary by the field conditions, should be implemented throughout construction such that the groundwater is always controlled and maintained at an elevation of at least 2 feet below the excavation bottom. Every effort should be made to keep the excavations dry if water is encountered.

In view of the maximum frost penetration depth of 42 inches, it is anticipated that about 4-foot-deep excavations will have to be performed within the native soils to allow for construction of the foundation system for the proposed building additions. Water should not be allowed to collect near the foundation or floor slab areas of the building either during or after construction. Undercut or excavated areas should be sloped toward one corner to facilitate removal of any collected rainwater, groundwater, or surface runoff. Positive site drainage should be provided to reduce infiltration of surface water around the perimeter of the building and beneath the floor slab. Overall site area drainage is to be arranged in a manner such that the possibility of water impounding below slab-on-grade areas and over the structural fill is prevented during construction.

4.2 SILTATION CONTROL

The Clean Water Act implemented in 1990 includes a federal permit program called the National Pollutant Discharge Elimination System (NPDES). This program requires that projects sites in excess of 1 acre or are part of a development which exceeds 1 acre be covered under a permit. This typically includes the development of a storm water pollution prevention plan (SWPPP) as well as period inspections (typically once a week plus after significant rainfall). PSI is available to assist with these services.

4.3 UTILITY TRENCHING

Excavation for utility trenches should be performed in accordance with OSHA regulations as stated in 29 CFR Part 1926. It should be noted that utility trench excavations have the potential to degrade the properties of the adjacent subsurface materials. Utility trench walls that are allowed to move laterally can lead to reduced bearing capacity and increased settlement of adjacent structural elements and overlying slabs.

Backfill for utility trenches is as important as the original subgrade preparation or structural fill placed to support a foundation or slab. Therefore, it is imperative that the backfill for utility trenches be placed to meet the project specifications for the structural fill on this project and backfilled and compacted as recommended in this report. Backfilling of utility trenches should not be performed with water standing in the trench.

4.4 SHALLOW EXCAVATIONS

In Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, Part 1926, Subpart P." This document was issued to better ensure the safety of workers entering trenches or excavations. It is mandated by this federal regulation that all excavations, whether they be utility trenches, basement excavations or foundation excavations, be constructed in accordance with the OSHA guidelines. It is our understanding that these regulations are being strictly enforced. If they are not followed closely, the Owner and the Contractor could be liable for substantial penalties.

The Contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The Contractor's "responsible person" as defined in "CFR Part 1926," should evaluate the soil exposed in the excavations as part of the Contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

We are providing this information solely as a service to our Client. PSI is not assuming responsibility for construction site safety or the Contractor's activities; such responsibility is not being implied and should not be inferred. If the excavations are left open and exposed to the elements for a significant length of time, desiccation of the clays may create minute shrinkage cracks which could allow large pieces of clay to collapse or slide into the excavation.

Materials removed from the excavation should not be stockpiled immediately adjacent to the excavation, as this load may cause a collapse of the embankment.

4.5 DEWATERING

It is our opinion that the methods, means and sequence of dewatering/rewatering should also be the responsibility of the Contractor who should be experienced in this type of construction. However, the following general guidance with regard to dewatering/rewatering is offered. The subsoils encountered at the anticipated depth of foundation are subject to a loss in shear strength due to reworking or poor groundwater control.

Based on the test borings, it is believed that infiltration of groundwater into short-term shallow excavations could be effectively controlled with normal sump pumping. However, a dewatering system (well points, wells, etc.) may be needed to assure good stability with regard to bottom heave or instability for long-term and relatively deep

excavations. In this regard, the piezometric head in these permeable soils should be maintained at or below the elevation of the bottom excavation. Lack of groundwater control could affect the stability of the excavations. In any event, it is recommended that all excavations be backfilled as soon as possible to avoid long-term pumping which could result in a general lowering of the water table and associated areal settlements.

4.6 WEATHER CONSIDERATIONS

The soils encountered at this site are sensitive to disturbances caused by construction traffic and to changes in moisture content. During wet weather periods, increases in the moisture content of the soil can cause significant reduction in soil strength and support capabilities. Care should be exercised during the grading operations at the site. Due to the fine-grained nature of the surficial soils, the traffic of heavy equipment, including heavy compaction equipment, may very well create pumping and a general deterioration of those soils in the presence of water. Therefore, the grading should, if possible, be performed during the dry season. A layer of crushed stone may be required to allow the movement of construction traffic over the site during the rainy season. The Contractor should maintain positive site drainage and if wet/pumping conditions occur, the Contractor will be responsible for over excavating the wet soils and replace them with a properly compacted structural fill. During wet seasons, limestone stabilization may be required to place structural fill.

4.7 CONSTRUCTION MONITORING

Consideration should be given to the impact of all of the proposed construction activities including demolition or removal of existing pavement materials and any common walls, utilities, structural elements, etc. within or near the existing main building as well as the construction of the new addition on the integrity and stability of the main building and any installed equipment or machinery, stored materials, nearby existing structures, foundation systems, utilities, pavements, etc. A detailed QA/QC program should be developed and strictly followed through the project. This may include performing a thorough preconstruction inspection of the site and structure conditions to document any existing distress, cracks, movements, etc. This could include the use of videotaping, photographs, instrumentation, sensors, geodetic surveys, etc. The QA/QC program should include close monitoring of construction vibrations and movements, stability of excavations, dewatering activities, etc. and their possible impact on the existing building and nearby structures. In this regard, it is recommended that background vibration levels be established in advance of construction. This should be performed over some period to determine the impact of occasional heavy traffic (school busses, garbage trucks, city busses, delivery trucks, etc.). In addition, the selected Contractor should be specialized in this type of construction and should be prepared to take all necessary measures to preserve the conditions and integrity of the existing building and all surrounding elements including the use of any necessary shoring, underpinning, bracing, etc. as needed.

We are providing this information solely as a service to our Client. PSI does not assume responsibility for construction site safety or the contractor's or other party’s compliance with local, state, and federal safety or other regulations.

5 GEOTECHNICAL RISK

The concept of risk is an important aspect of the geotechnical evaluation. The primary reason for this is that the analytical methods used to develop geotechnical recommendations do not comprise an exact science. Site exploration identifies actual subsurface conditions only at those points where samples are taken. A geotechnical report is based on conditions that existed at the time of the subsurface exploration. The analytical tools which geotechnical engineers use are generally empirical and must be used in conjunction with engineering judgment and experience. Therefore, the solutions and recommendations presented in the geotechnical evaluation should not be considered risk-free and, more importantly, are not a guarantee that the interaction between the soils and the proposed structure will perform as planned. The geotechnical related recommendations and general construction guidance presented in the preceding sections constitute PSI's professional estimate of those measures that are necessary for the proposed structure to perform according to the proposed design based on the information generated and referenced during this evaluation, and PSI's experience in working with these conditions.

6 REPORT LIMITATIONS

The recommendations submitted in this report are based on the available subsurface information obtained by PSI and design details provided by Cleveland Public Library. If there are any revisions to the plans for the proposed structures, or if deviations from the subsurface conditions noted in this report are encountered during construction, PSI should be retained to determine if changes in the recommendations are required. If PSI is not retained to perform these functions, PSI will not be responsible for the impact of those conditions on the geotechnical recommendations for the project.

The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein, have been presented after being prepared in accordance with generally accepted professional engineering practice in the fields of foundation engineering, soil mechanics and engineering geology. No other warranties are implied or expressed.

After the plans and specifications are complete, it is recommended that PSI be provided with the opportunity to review the final design and specifications, in order to verify that the earthwork and foundation recommendations are properly interpreted and implemented. At that time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of **Cleveland Public Library** in connection with the proposed **Cleveland Public Library Fleet Branch Expansion and Renovation** located at 7224 Broadway Avenue, Cleveland, Cuyahoga County, OH 44105

APPENDIX

SITE LOCATION PLAN

BORING LOCATION PLAN

BORING LOGS

ROCK CORE LOG

PAVEMENT CORE LOG

GRAIN SIZE DISTRIBUTION CHART

ATTERBERG LIMIT TEST RESULTS

GENERAL NOTES & SOIL CLASSIFICATION CHART



intertek psi

5555 Canal Road, Cleveland OH 44125
Phone 216-447-1335

Not to Scale

Site Vicinity Map

Figure 1

PROJECT NO.:	**0142-2962**
PROJECT NAME:	**Cleveland Public Library Fleet Branch Expansion and Renovation**
LOCATION:	**7224 Broadway Avenue, Cleveland, Cuyahoga County, OH 44205**



intertek psi
5555 Canal Road, Cleveland OH 44125
Phone 216-447-1335

Not to Scale

Boring Location Map

Figure 2

PROJECT NO.:	**0142-2962**
PROJECT NAME:	**Cleveland Public Library Fleet Branch Expansion and Renovation**
LOCATION:	**7224 Broadway Avenue, Cleveland, Cuyahoga County, OH 44205**

BORING B-1

DATE STARTED:	11/26/25	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	11/26/25	**DRILLER:** RA	**LOGGED BY:** RH
COMPLETION DEPTH	24.0 ft	**DRILL RIG:**	ATV-mounted CME-55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	723 ft	**SAMPLING METHOD:**	2-in SS-in Core
LATITUDE:	41.457183°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-81.637839°	**EFFICIENCY**	96%
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Robert Price

REMARKS: Approximate boring elevation/coordinates were obtained from Google Earth Pro

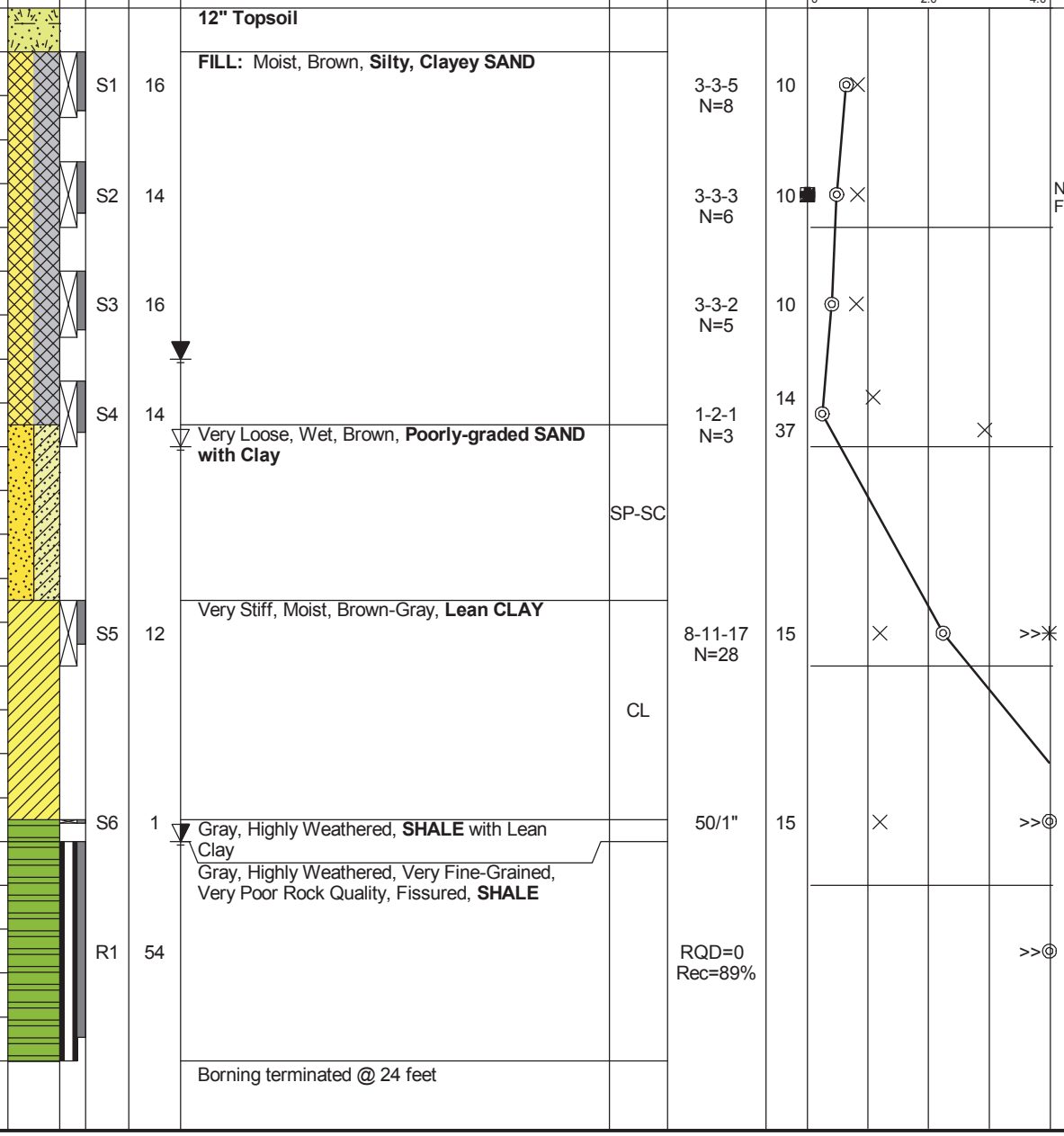
Water

While Drilling	10.0 feet
Upon Completion	8.0 feet
Water Introduced	19.0 feet

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS) RQD & Recovery % (NX)	Moisture, %	Additional Remarks
	0			**12" Topsoil**				
		S1	16	**FILL:** Moist, Brown, **Silty, Clayey SAND**		3-3-5 N=8	10	
720		S2	14			3-3-3 N=6	10	Non-Plastic Fines=12.8%
	5	S3	16			3-3-2 N=5	10	
715		S4	14			1-2-1 N=3	14 37	
	10			Very Loose, Wet, Brown, **Poorly-graded SAND with Clay**	SP-SC			
710		S5	12	Very Stiff, Moist, Brown-Gray, **Lean CLAY**	CL	8-11-17 N=28	15	
	15							
705		S6	1	Gray, Highly Weathered, **SHALE** with Lean Clay		50/1"	15	
	20	R1	54	Gray, Highly Weathered, Very Fine-Grained, Very Poor Rock Quality, Fissured, **SHALE**		RQD=0 Rec=89%		
700				Borning terminated @ 24 feet				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0



intertek psi

Professional Service Industries, Inc.
5555 Canal Road
Cleveland, OH 44125
Telephone: (216) 447-1335

PROJECT NO.: 0142-2962
PROJECT: CPL - Fleet Branch Expansion & Reno
LOCATION: 7224 Broadway Ave
Cleveland, Cuyahoga County, OH

The stratification lines represent approximate boundaries. The transition may be gradual.

BORING B-2

DATE STARTED:	11/26/25	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	11/26/25	**DRILLER:** RA	**LOGGED BY:** RH
COMPLETION DEPTH	25.7 ft	**DRILL RIG:**	ATV-mounted CME-55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	723 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	41.457178°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-81.637923°	**EFFICIENCY**	96%
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Robert Price

Water

While Drilling	13.0 feet
Upon Completion	None
Caved Depth	19.0 feet

BORING LOCATION:

REMARKS: Approximate boring elevation/coordinates were obtained from Google Earth Pro

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0, 25, 50) STRENGTH, tsf ▲ Qu ✳ Qp (0, 2.0, 4.0)	Additional Remarks
	0					**10" Topsoil**					
				S1	17	**FILL:** Moist, Brown, **Sandy Lean CLAY with Gravel**		3-5-7 N=12	8		
720											
				S2	14	**FILL:** Moist, Brown, **Poorly-graded SAND with Gravel**, (including Cobbles)		9-5-5 N=10	11		
	5										
				S3	15	**FILL:** Moist, Brown, **Poorly-graded SAND**		3-3-6 N=9	8		
715											
				S4	14			2-1-2 N=3	14		
	10										
710											
				S5	18	**Very Stiff, Moist, Brown-Gray,** Lean CLAY	CL	7-8-11 N=19	14	>>✳	
	15										
705				S6	1	Gray, Highly Weathered, **SHALE**		50/1"		>>◎	
	20										
700				S7	2			50/2"		>>◎	
						Borning terminated @ 23.7 feet					
	25										

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PROJECT NO.: 0142-2962
PROJECT: CPL - Fleet Branch Expansion & Reno
LOCATION: 7224 Broadway Ave
Cleveland, Cuyahoga County, OH

The stratification lines represent approximate boundaries. The transition may be gradual.

BORING B-3

DATE STARTED:	11/26/25	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	11/26/25	**DRILLER:** RA	**LOGGED BY:** RH
COMPLETION DEPTH	24.5 ft	**DRILL RIG:**	ATV-mounted CME-55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	723 ft	**SAMPLING METHOD:**	2-in SS-in Core
LATITUDE:	41.456941°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-81.637954°	**EFFICIENCY**	96%
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Robert Price

Water

While Drilling	8.5 feet
Upon Completion	None
Water Introduced	19.5 feet

BORING LOCATION:

REMARKS: Approximate boring elevation/coordinates were obtained from Google Earth Pro

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS) RQD & Recovery % (NX)	Moisture, %	Additional Remarks
	0			**5" Topsoil**				
		S1	9	**FILL:** Moist, Brown, **Well-graded SAND with Clay and Gravel**		4-26-10 N=36	12	
720		S2	14			4-5-5 N=10	8	
	5	S3	14	**FILL:** Moist, Brown, **Poorly-graded SAND**		3-3-3 N=6	7	
715		S4	9			2-1-2 N=3	23	
	10	S5	10	Medium Stiff, Moist, Brown-Gray, **Lean CLAY**	CL	1-2-3 N=5	18	LL = 30 PL = 18 Fines=85.2%
710								
	15	S6	2	Gray, Highly Weathered, **SHALE**		50/2"		>>
705				Gray, Highly Weathered, Very Fine-Grained, Very Poor Rock Quality, Fissured, **SHALE**				
	20	R1	48			RQD=0 Rec=80%		>>
700				Borning terminated @ 24.5 feet				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0

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PROJECT NO.: 0142-2962
PROJECT: CPL - Fleet Branch Expansion & Reno
LOCATION: 7224 Broadway Ave
Cleveland, Cuyahoga County, OH

The stratification lines represent approximate boundaries. The transition may be gradual.



Bore No.:	Run No.:	Run Depth:	Recovery:	RQD:
B-1	**1 of 1**	**19.0 to 24.0**	**89%**	**0%**

intertek psi	**CPL - Fleet Branch Expansion and Renovation** **7224 Broadway Avenue** **Cleveland, Cuyahoga County, OH 44105**	**Prepped By: RH**	**Rock Core Photo Log**
		Date: 12/01/2025	**PSI Project No.: 0142-2962**



Bore No.:	Run No.:	Run Depth:	Recovery:	RQD:
B-3	**1 of 1**	**19.5 to 24.5**	**80%**	**0%**

intertek psi	**CPL - Fleet Branch Expansion and Renovation** **7224 Broadway Avenue** **Cleveland, Cuyahoga County, OH 44105**	**Prepped By: RH**	**Rock Core Photo Log**
		Date: 12/01/2025	**PSI Project No.: 0142-2962**

Core Photo: C-01



Core Info		
Core Composition	**Core Thickness**	**Remarks**
Concrete	5.25”	Fair Condition
Total Pavement Thickness	5.25”	
Base	6”	Moist, Brown, Well-graded SAND with Clay and Gravel

intertek psi

Cleveland Public Library
Fleet Branch Expansion and Renovation
7224 Broadway Ave
Cleveland, Cuyahoga County, Ohio

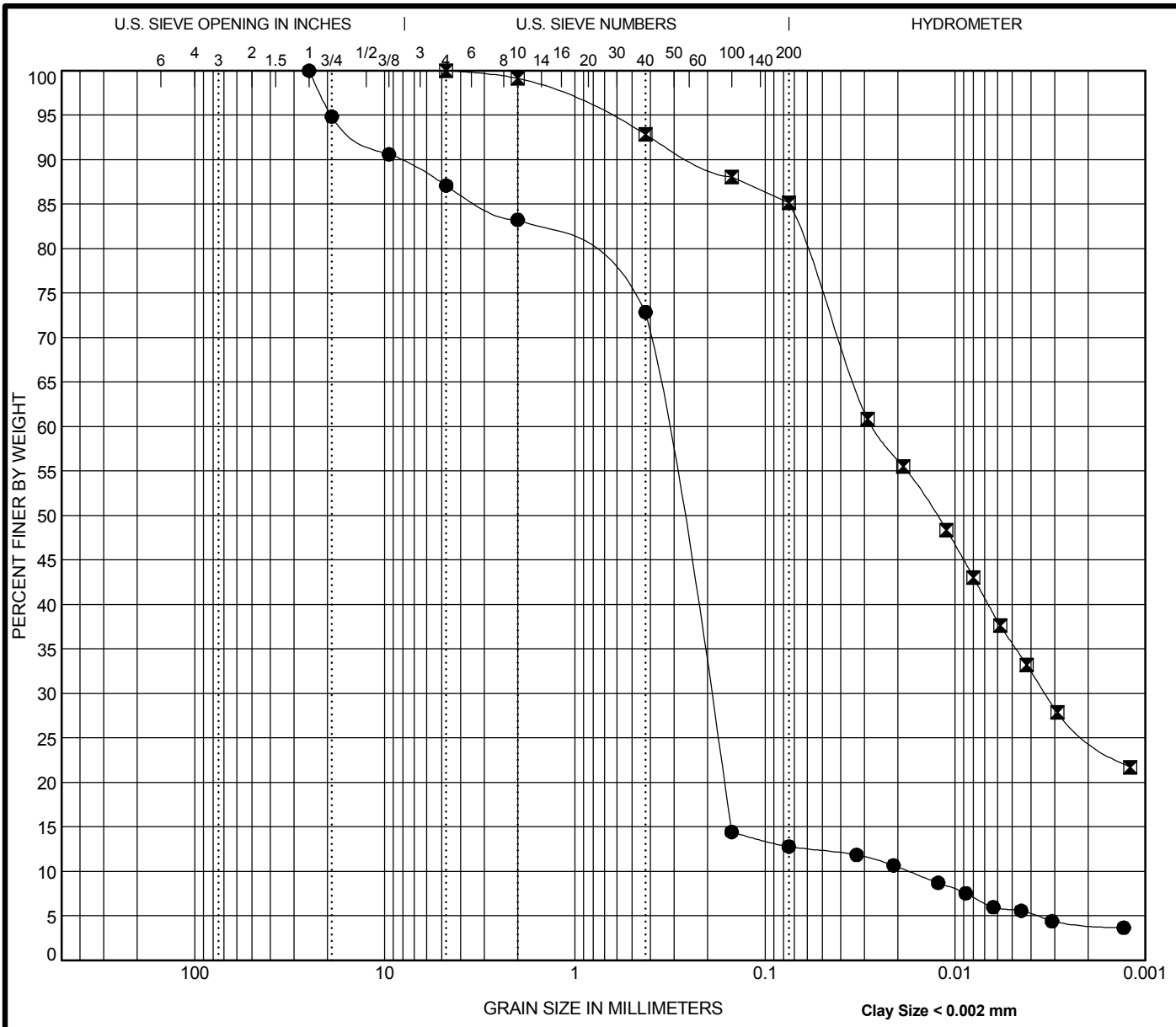
Date: 12/03/2025

Taken By: RH

Scale: NA

Core Photo Log

PSI Project No. 0142-2962



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-1	4.3	Silty, Clayey SAND (SC-SM)	NP	NP	NP	6.63	19.31
⊠	B-3	14.3	Lean CLAY (CL)	30	18	12		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-1	4.3	25	0.338	0.198	0.018	12.9	74.3	8.8	4.0
⊠	B-3	14.3	4.75	0.027	0.003		0.0	14.8	59.9	25.3

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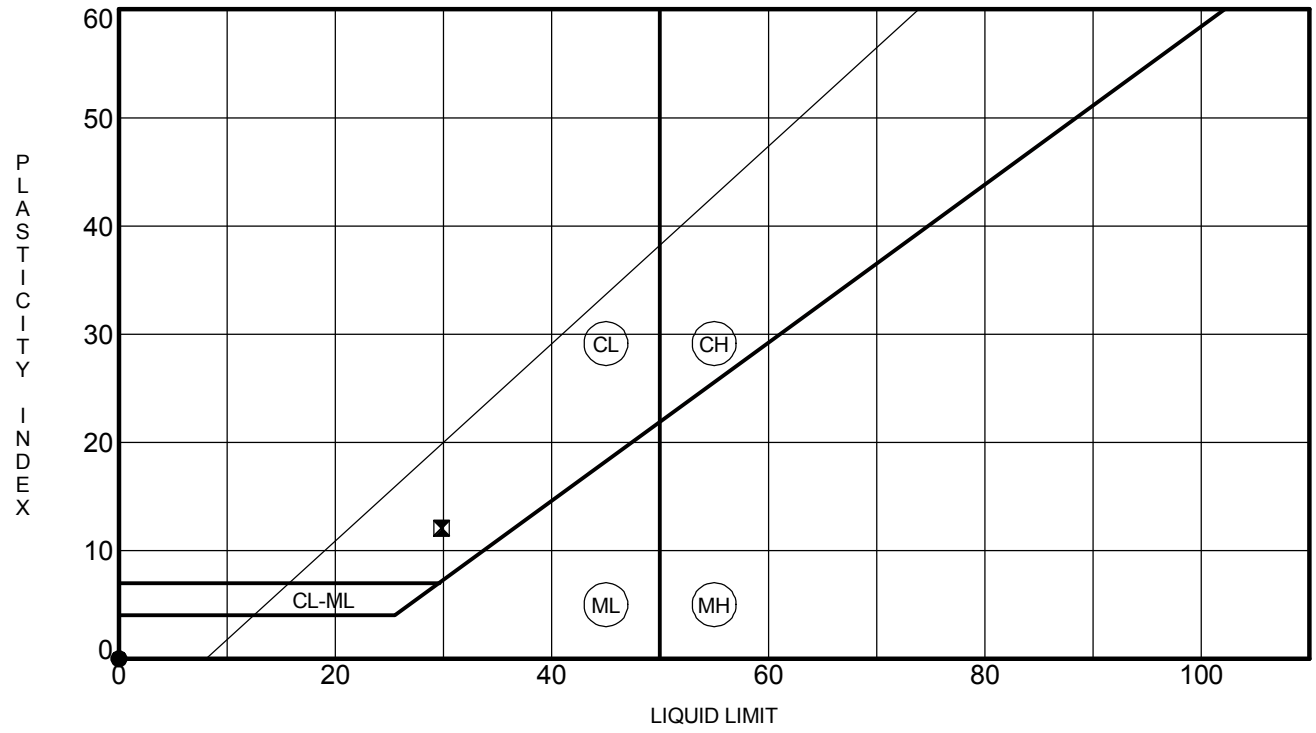
GRAIN SIZE DISTRIBUTION

Project: CPL - Fleet Branch Expansion & Reno
PSI Job No.: 0142-2962
Location: 7224 Broadway Ave
Cleveland, Cuyahoga County, OH



	Boring	Depth (ft)	LL	PL	PI	Fines	Classification (*Visual)
●	**B-1**	**4.3**	**NP**	**NP**	**NP**	**12.8**	**Silty, Clayey SAND (SC-SM)**
⊠	**B-3**	**14.3**	**30**	**18**	**12**	**85.2**	**Lean CLAY (CL)**

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ATTERBERG LIMIT RESULTS

PSI Job No.: 0142-2962
Project: CPL - Fleet Branch Expansion & Reno
Location: 7224 Broadway Ave
Cleveland, Cuyahoga County, OH

GENERAL NOTES

SAMPLE IDENTIFICATION

The Unified Soil Classification System (USCS), AASHTO 1988 and ASTM designations D2487 and D-2488 are used to identify the encountered materials unless otherwise noted. Coarse-grained soils are defined as having more than 50% of their dry weight retained on a #200 sieve (0.075mm); they are described as: boulders, cobbles, gravel or sand. Fine-grained soils have less than 50% of their dry weight retained on a #200 sieve; they are defined as silts or clay depending on their Atterberg Limit attributes. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size.

DRILLING AND SAMPLING SYMBOLS

SFA: Solid Flight Auger - typically 4" diameter flights, except where noted.
HSA: Hollow Stem Auger - typically 3¼" or 4¼ I.D. openings, except where noted.
M.R.: Mud Rotary - Uses a rotary head with Bentonite or Polymer Slurry
R.C.: Diamond Bit Core Sampler
H.A.: Hand Auger
P.A.: Power Auger - Handheld motorized auger

SS: Split-Spoon - 1 3/8" I.D., 2" O.D., except where noted.
ST: Shelby Tube - 3" O.D., except where noted.
BS: Bulk Sample
PM: Pressuremeter
CPT-U: Cone Penetrometer Testing with Pore-Pressure Readings

SOIL PROPERTY SYMBOLS

N: Standard "N" penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2-inch O.D. Split-Spoon.
N_{60}: A "N" penetration value corrected to an equivalent 60% hammer energy transfer efficiency (ETR)
Q_u: Unconfined compressive strength, TSF
Q_p: Pocket penetrometer value, unconfined compressive strength, TSF
w%: Moisture/water content, %
LL: Liquid Limit, %
PL: Plastic Limit, %
PI: Plasticity Index = (LL-PL),%
DD: Dry unit weight, pcf
▼,▽,▼ Apparent groundwater level at time noted

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Relative Density	N - Blows/foot
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	50 - 80
Extremely Dense	80+

ANGULARITY OF COARSE-GRAINED PARTICLES

Description	Criteria
Angular:	Particles have sharp edges and relatively plane sides with unpolished surfaces
Subangular:	Particles are similar to angular description, but have rounded edges
Subrounded:	Particles have nearly plane sides, but have well-rounded corners and edges
Rounded:	Particles have smoothly curved sides and no edges

GRAIN-SIZE TERMINOLOGY

Component	Size Range
Boulders:	Over 300 mm (>12 in.)
Cobbles:	75 mm to 300 mm (3 in. to 12 in.)
Coarse-Grained Gravel:	19 mm to 75 mm (¾ in. to 3 in.)
Fine-Grained Gravel:	4.75 mm to 19 mm (No.4 to ¾ in.)
Coarse-Grained Sand:	2 mm to 4.75 mm (No.10 to No.4)
Medium-Grained Sand:	0.42 mm to 2 mm (No.40 to No.10)
Fine-Grained Sand:	0.075 mm to 0.42 mm (No. 200 to No.40)
Silt:	0.002 mm to 0.075 mm
Clay:	<0.002mm to <0.005 mm depending on agency

PARTICLE SHAPE

Description	Criteria
Flat:	Particles with width/thickness ratio > 3
Elongated:	Particles with length/width ratio > 3
Flat & Elongated:	Particles meet criteria for both flat and elongated

RELATIVE PROPORTIONS OF FINES

Descriptive Term	% Dry Weight
Trace:	< 5%
With:	5% to 12%
Modifier:	>12%

GENERAL NOTES

(Continued)

CONSISTENCY OF FINE-GRAINED SOILS

Q_U - TSF	N - Blows/foot	Consistency
0 - 0.25	0 - 2	Very Soft
0.25 - 0.50	2 - 4	Soft
0.50 - 1.00	4 - 8	Firm (Medium Stiff)
1.00 - 2.00	8 - 15	Stiff
2.00 - 4.00	15 - 30	Very Stiff
4.00 - 8.00	30 - 50	Hard
8.00+	50+	Very Hard

MOISTURE CONDITION DESCRIPTION

Description	Criteria
Dry:	Absence of moisture, dusty, dry to the touch
Moist:	Damp but no visible water
Wet:	Visible free water, usually soil is below water table

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term	% Dry Weight
Trace:	< 15%
With:	15% to 30%
Modifier:	>30%

STRUCTURE DESCRIPTION

Description	Criteria
Stratified:	Alternating layers of varying material or color with layers at least ¼-inch (6 mm) thick
Laminated:	Alternating layers of varying material or color with layers less than ¼-inch (6 mm) thick
Fissured:	Breaks along definite planes of fracture with little resistance to fracturing
Slickensided:	Fracture planes appear polished or glossy, sometimes striated
Blocky:	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
Lensed:	Inclusion of small pockets of different soils
Layer:	Inclusion greater than 3 inches thick (75 mm)
Seam:	Inclusion 1/8-inch to 3 inches (3 to 75 mm) thick extending through the sample
Parting:	Inclusion less than 1/8-inch (3 mm) thick

SCALE OF RELATIVE ROCK HARDNESS

Q_U - TSF	Consistency
2.5 - 10	Extremely Soft
10 - 50	Very Soft
50 - 250	Soft
250 - 525	Medium Hard
525 - 1,050	Moderately Hard
1,050 - 2,600	Hard
>2,600	Very Hard

ROCK BEDDING THICKNESSES

Description	Criteria
Very Thick Bedded	Greater than 3-foot (>1.0 m)
Thick Bedded	1-foot to 3-foot (0.3 m to 1.0 m)
Medium Bedded	4-inch to 1-foot (0.1 m to 0.3 m)
Thin Bedded	1¼-inch to 4-inch (30 mm to 100 mm)
Very Thin Bedded	½-inch to 1¼-inch (10 mm to 30 mm)
Thickly Laminated	1/8-inch to ½-inch (3 mm to 10 mm)
Thinly Laminated	1/8-inch or less "paper thin" (<3 mm)

ROCK VOIDS

Voids	Void Diameter
Pit	<6 mm (<0.25 in)
Vug	6 mm to 50 mm (0.25 in to 2 in)
Cavity	50 mm to 600 mm (2 in to 24 in)
Cave	>600 mm (>24 in)

GRAIN-SIZED TERMINOLOGY

(Typically Sedimentary Rock)

Component	Size Range
Very Coarse Grained	>4.76 mm
Coarse Grained	2.0 mm - 4.76 mm
Medium Grained	0.42 mm - 2.0 mm
Fine Grained	0.075 mm - 0.42 mm
Very Fine Grained	<0.075 mm

ROCK QUALITY DESCRIPTION

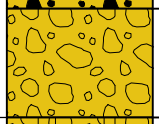
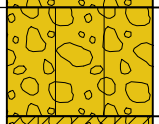
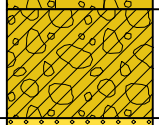
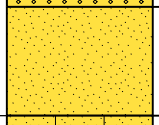
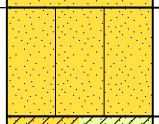
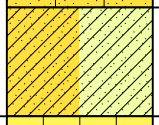
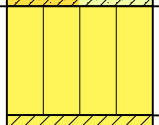
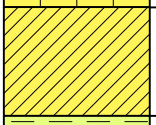
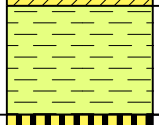
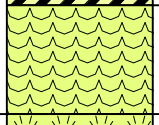
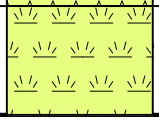
Rock Mass Description	RQD Value
Excellent	90 -100
Good	75 - 90
Fair	50 - 75
Poor	25 -50
Very Poor	Less than 25

DEGREE OF WEATHERING

Slightly Weathered:	Rock generally fresh, joints stained and discoloration extends into rock up to 25 mm (1 in), open joints may contain clay, core rings under hammer impact.
Weathered:	Rock mass is decomposed 50% or less, significant portions of the rock show discoloration and weathering effects, cores cannot be broken by hand or scraped by knife.
Highly Weathered:	Rock mass is more than 50% decomposed, complete discoloration of rock fabric, core may be extremely broken and gives clunk sound when struck by hammer, may be shaved with a knife.

SOIL CLASSIFICATION CHART

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

intertek psi

CLEVELAND PUBLIC LIBRARY

EXPERIENTIAL BRANDING STANDARDS

00.00.2025

Moody Nolan

EXPERIENTIAL DESIGN STUDIO

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1.0

INTRODUCTION

0.1 Standards Overview

0.2 Do’s and Dont’s

0.3 Recommendations

0.1 STANDARDS OVERVIEW

The Cleveland Public Library (CPL) Interior & Exterior Signage Standards serve as a comprehensive guide for architects, designers, and CPL employees to ensure a cohesive and effective signage system across all CPL locations. These standards provide guidelines for maintaining brand consistency, improving navigation, and ensuring compliance with accessibility and local regulations. They must be referenced at every stage of signage planning, design, fabrication, and installation.

1. When to Use These Standards

These standards should be followed whenever exterior signage is being designed, installed, modified, or replaced at any CPL location. They apply to:

I. New construction and renovations
II. Updates to existing signage
III. Temporary signage needs
IV. Wayfinding improvements
V. Compliance reviews for local regulations and accessibility

2. Visual Identity & Brand Consistency

All exterior signage must align with CPL's brand identity to maintain consistency across branches, campuses, and facilities. When designing or specifying signage:

I. Use approved fonts, colors, and logo applications.
II. Follow size and placement guidelines to ensure visibility and uniformity.
III. Reference provided design templates and material specifications.

3. Navigation & Wayfinding

Signage must be designed and positioned to help visitors easily identify, enter, and navigate CPL facilities. When planning wayfinding signage:

I. Assess high-traffic areas and key decision points.
II. Use clear, concise messaging that aligns with CPL's wayfinding hierarchy.
III. Ensure consistency in directional signage across multiple locations.

4. Reducing Confusion in Complex Campuses

In multi-building or large-scale CPL locations, the exterior signage system should minimize confusion by:

I. Clearly designating entry points, pathways, and key destinations.
II. Incorporating maps or directory signage where necessary.
III. Using standardized symbols and terminology for clarity.

5. Compliance with Local Regulations

All signage installations must comply with local zoning laws, building codes, and other municipal or state regulations. When planning signage:

I. Verify that placement, size, and illumination comply with applicable codes.
II. Consult CPL's project or brand manager if there are any compliance concerns.
III. Obtain required permits before fabrication and installation.

6. Accessibility Standards

All exterior signage must meet accessibility requirements to ensure inclusivity for all visitors. When designing signage:

I. Use high-contrast text and backgrounds for readability.
II. Incorporate tactile and Braille elements where required.
III. Position signs at appropriate heights and angles for visibility.

7. Materials & Maintenance Guidelines

The signage system is designed for long-term durability and ease of maintenance. When specifying materials:

I. Use approved materials to ensure consistency and longevity.
II. Design for weather resistance and minimal upkeep.

Note to Designers or Specifiers:

If a project need or requires additional design components, submit any new design elements or material modifications for CPL brand manager approval before implementation.

By adhering to these standards, architects, designers, and CPL employees will contribute to a seamless and user-friendly library experience. If there are any uncertainties or deviations required, consult CPL's project or brand manager for guidance.

0.2 DO'S AND DONT'S

This page is intended to provide the design team with clear guidance on the appropriate and inappropriate use of Cleveland Public Library's graphic and branding standards. While the standards establish the visual identity system, the Dos and Don'ts ensure consistent application across all branches, projects, and communication platforms. By outlining common pitfalls and reinforcing best practices, this section helps protect the integrity of the CPL brand, maintains clarity for library users, and ensures that every design—whether signage, wayfinding, or environmental graphics—reflects the library's values of accessibility, consistency, and community connection.

DO'S

Do follow approved brand colors, fonts, and lock-ups as outlined in the Cleveland Public Library (CPL) branding standards.

Do prioritize legibility and accessibility in all signage, environmental graphics, and print/digital materials—ensuring ADA compliance and readability across multiple scales.

Do respect the hierarchy of messaging by maintaining consistent use of CPL's primary logo, sub-brands, and campus identifiers.

Do incorporate community- and branch-specific customizations only within the flexible elements permitted by the standards (e.g., campus map watercolors, local imagery), while keeping the overall CPL identity intact.

Do use approved templates for signage layouts, typography treatments, and directional icons to ensure brand consistency across the system.

Do test visibility and placement of signage to ensure wayfinding clarity from key entry points and circulation paths.

Do coordinate early with CPL's branding team when introducing new graphic applications or environmental elements to confirm alignment.

Do maintain quality standards for fabrication, finishes, and installations—using durable materials that reflect CPL's long-term civic presence.

DONT'S

Don't alter or stretch the CPL logo in any way, including proportions, orientation, or color.

Don't substitute unapproved fonts or colors for any branded materials.

Don't overcrowd signage or graphics with unnecessary text, imagery, or competing elements that dilute the CPL brand.

Don't apply local or branch identities in a way that overshadows or conflicts with the CPL master brand.

Don't use unapproved background patterns, gradients, or textures behind the CPL logo or brand typography.

Don't place signage in areas where visibility is obstructed, compromised by poor lighting, or conflicts with architectural elements.

Don't improvise with directional icons or symbols—always use the approved library iconography set.

Don't bypass the review/approval process for new applications, renovations, or one-off design solutions that affect branded spaces.

0.3 RECOMMENDATIONS

This page is needed to set clear expectations for how the Cleveland Public Library, architects, and design teams must work together to uphold the integrity of the CPL brand. By outlining best practices, it ensures that every project—whether new construction, renovation, or environmental branding—follows a consistent and transparent process. Comprehensive construction documentation, detailed visuals, and early coordination are essential to avoid misinterpretation, ensure accessibility and quality, and provide CPL with the information required for thorough review and approval. Establishing these guidelines not only protects the library's identity system but also creates accountability among all project partners, reinforcing CPL's role as a civic institution committed to clarity, consistency, and excellence.

Cleveland Public Library (CPL)

Maintain Brand Stewardship: Establish a centralized point of contact or branding review committee to oversee all applications of CPL's visual identity across branches and projects.

Provide Updated Resources: Ensure that design teams always have access to the latest digital standards, logo files, and templates through an accessible brand portal.

Facilitate Training: Host periodic orientation sessions or workshops for architects, consultants, and internal staff to review updates and reinforce proper brand application.

Encourage Flexibility Within Consistency: Allow space for branch-level customization (e.g., community-inspired graphics, local storytelling) while ensuring these elements fit within the master brand framework.

Prioritize Long-Term Quality: Approve materials and fabrication methods that reinforce CPL's civic presence and durability, avoiding short-term fixes that weaken the system over time.

Require Comprehensive Documentation: Insist that all design and architectural teams submit full construction documentation—including detailed signage location plans, message schedules, elevations, specifications, and material samples—accompanied by visual mockups for CPL's review and approval prior to fabrication and installation.

For Design Teams

Adhere to Standards: Follow the graphic and branding guidelines without deviation, ensuring consistency in typography, color, logo use, and iconography.

Design for Accessibility: Ensure all applications—digital and physical—are fully legible, inclusive, and compliant with ADA and universal design principles.

Balance Master Brand with Local Expression: Introduce branch-specific personality only within the approved flexible elements of the CPL system.

Engage in Collaborative Reviews: Share concepts and mockups with CPL stakeholders early to confirm alignment before production.

Maintain Quality Control: Work with fabricators to verify colors, finishes, and proportions match brand standards, requesting proofs and mockups when necessary.

For Architects

Integrate Branding Early: Incorporate CPL's graphic standards and signage strategies into the earliest design phases, aligning architectural intent with brand expression.

Consider Placement and Visibility: Collaborate with the design team to ensure signage locations are architecturally harmonious, ADA compliant, and highly visible for visitors.

Avoid Conflicts with Architectural Features: Ensure wayfinding and brand elements complement, rather than compete with, the architectural character of CPL buildings.

Document and Coordinate: Provide comprehensive construction documentation, including dimensioned sign location plans, installation details, and finish schedules, that adhere to CPL's brand standards.

Champion Brand Integrity: Serve as an advocate for CPL's identity when coordinating with consultants, contractors, and fabricators.

1.0

VISUAL BRAND OVERVIEW

1.1 Logo

1.2 Colors

1.3 Typography

Primary Logo





Secondary Logo





Building Blocks

Type only



Mark only



Usage



When the logo is used in marketing materials, a minimum amount of clear space must surround the logo.

Space around logo should be equal to the height of the “diamond”.



.875"



.375"



.375”

CLEVELAND
PUBLIC
LIBRARY

.625"

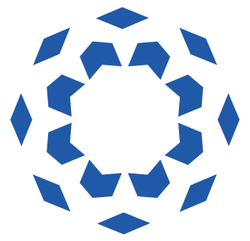


The primary logo may not be reproduced any smaller than .875" wide to maintain legibility. If a smaller logo is needed, we suggest using the horizontal mark, the text, or just the icon—no smaller than .375" or .625" wide, respectively.

Line Weights

Line weight is related to scale. When elements are 1" line weight should be 1 pt. for a ratio of 1:1.

1"

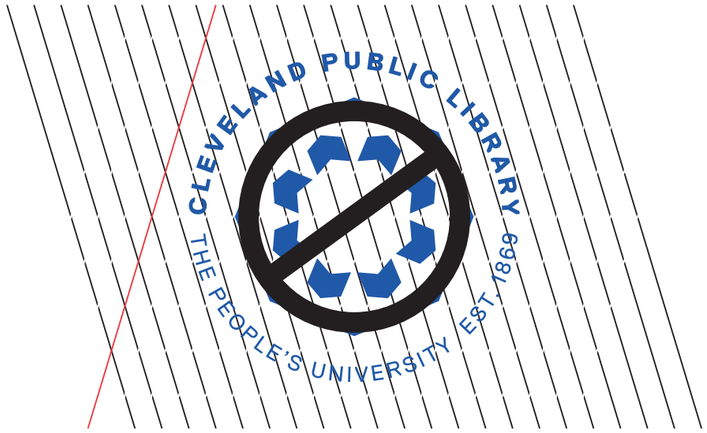


CLEVELAND
PUBLIC
LIBRARY

FOUNDATION

1 pt. line weight

Improper Logo Usage



Patterned background



Distortion of the logo



Usage of color outside of the color palette



Special graphic effects to the logo



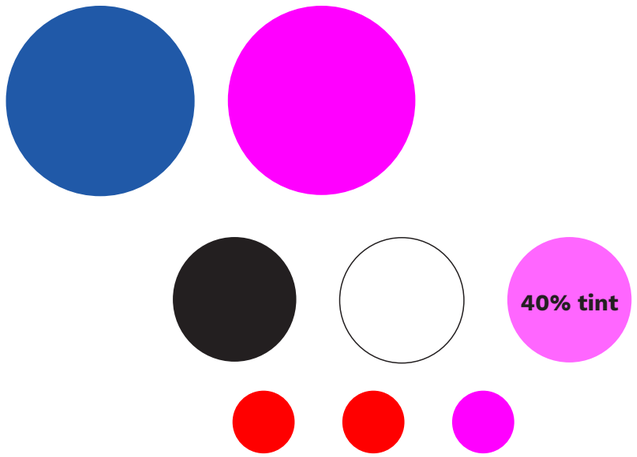
Usage of color outside of the color palette



Adding a stroke

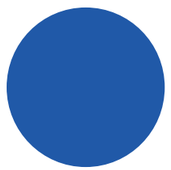
Color Relationships

1. PMS 2935 is the primary color associated with the CPL brand. Blue serves as an anchoring foundation.
2. Yellow (PMS 608) is the second primary color.
3. The combination of the blue and yellow is a traditional yet vibrant, distinctive, modern, and approachable.
4. Neutral colors can be used in combination with PMS 2935, PMS 608, and each other.
5. Secondary colors are used to support the primary colors. These colors should be used as large areas of singular color and should not be combined with one another.
6. Although individual pieces may vary, please notice that cumulative effect keeps the overall color balance.



Color

PRIMARY



PMS 2935
C100/**M**63/**Y**0/**K**2
R0/**G**87/**B**183
#0057B7



PMS 608
C5/**M**0/**Y**53/**K**0
R233/**G**225/**B**134
#E9E186

the logo may only be used in blue, black, or white

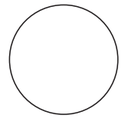
all official, primary Library materials should appear in the primary palette (business card, letterhead, exterior signage...)

NEUTRAL



PMS Warm Gray 2
C16/**M**15/**Y**16/**K**0
R203/**G**196/**B**188
#CBC4BC

PMS black
C20/**M**20/**Y**20/**K**100
R0/**G**0/**B**0
#000000



PMS white
C0/**M**0/**Y**0/**K**0
R255/**G**255/**B**255
#FFFFFF

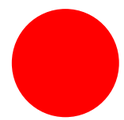


PMS 40% Warm Gray 2
C20/**M**20/**Y**23/**K**0
R203/**G**195/**B**187
#CBC2BB

PMS 8382
metallic only or in material applications

SECONDARY

not to be used with each other and only in secondary and tertiary materials (seasonal publications, swag)



PMS 170
C0/**M**54/**Y**58/**K**0
R255/**G**141/**B**126
#FF8D7E



PMS 7406
C0/**M**13/**Y**100/**K**1
R241/**G**196/**B**0
#F1C400



PMS 5503
C42/**M**11/**Y**16/**K**0
R148/**G**183/**B**187
#94B7BB

PMS 7459
C70/**M**17/**Y**10/**K**4
R66/**G**152/**B**181
#4298B5

PMS 362
C69/**M**0/**Y**100/**K**13
R86/**G**148/**B**79
#56944F

CPL Approved Fonts

THE BRAND VOICE: FOR USE IN HEADLINES

REPLICA, all weights
bold, modern, outgoing
distinctive, optimistic
1234567890

THE WORKHORSE:
FOR USE IN SUBHEADS AND BODY COPY

Work Sans, all weights
useful, friendly, direct, flexible
1234567890

GENERAL USE, MICROSOFT-FRIENDLY
FOR USE IN EMAIL AND MS PRODUCTS

SANS SERIF: CALIBRI

Calibri, all weights
subtly rounded design with a warm
and soft character 1234567890

SERIF: CONSTANTIA

ABCDEFGHIJKLMN
OPQRSTUVWXYZÀÅ
abcdefghijklmnopqrst

THE CLASSIC COMPLIMENT:
FOR USE IN SUBHEADS BODY COPY, AND CAPTIONS

Spectral, all weights
classic, progressive, transitional,
versatile 1234567890

2.0

INT. SIGNAGE & WAYFINDING

2.0 Signage Use
2.1 Typography & Materials
2.2 Pictograms & Arrows
2.3 Interior Signage Sign Types
2.4 Interior Signage Mounting Standards
2.5 Interior Signage Nomenclature
2.6 Book Shelf Tags
2.7 Book Shelf Icons
2.8 Community Wall Collateral Display
2.9 CPL Wall Collateral Display

2.0 SIGNAGE USE

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By adhering to these standards, architects, designers, and CPL employees will contribute to a seamless and user-friendly library experience. If there are any uncertainties or deviations required, consult CPL's project or brand manager for guidance.

WORK SANS (ADA)

ABCDEFGHIJKLMNOPQRSTUVWXYZ
1234567890

WORK SANS LITE

ABCDEFGHIJKLMNOPQRSTUVWXYZ
1234567890

REPLICA PRO REGULAR

ABCDEFGHIJKLMNOPQRSTUVWXYZ
1234567890

REPLICA PRO BOLD

ABCDEFGHIJKLMNOPQRSTUVWXYZ
1234567890

SIGN EXAMPLE



COLORS

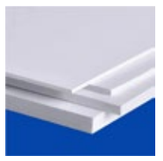
WHITE

BLUE
PMS 2935

MATERIALS



WHITE PAPER
PMS 2935C COPY



3MM WHITE
PALBOARD VIVID



MAN



WOMAN



ACCESSIBLE



WIFI



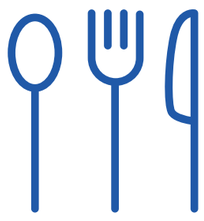
NO
SMOKING



INFORMATION



NO
FIREARMS



FOOD



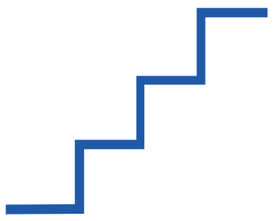
NO PHONES



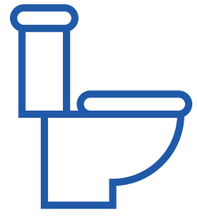
RECYCLING



SHOWER



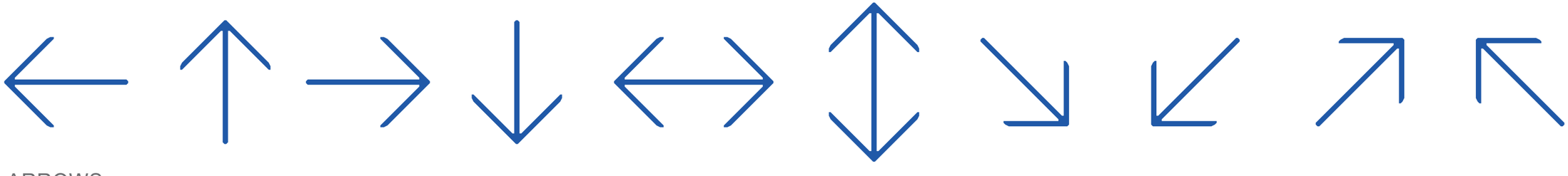
STAIRS



RESTROOM



USE STAIRS

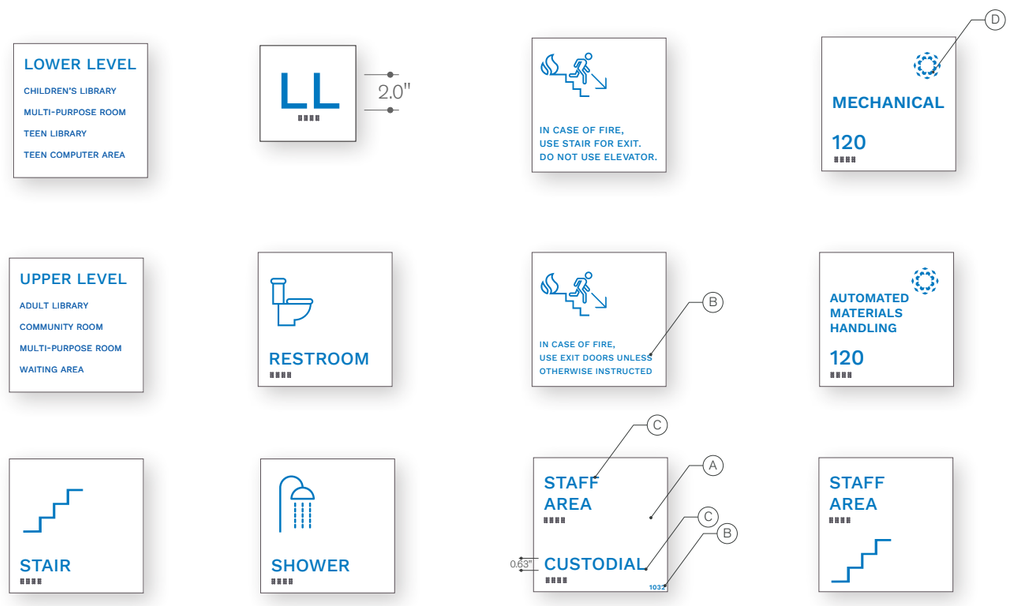


ARROWS

2.3 INTERIOR SIGNAGE SIGN TYPES

SIGN TYPE LIST

A.6	Directory 2
E	Stair ID 1
EL	Tactile Level ID 2
E.2	Restroom ID 4
E.4a	In Case Of Fire 1
E.4b	In Case Of Fire 1
G	Medium Room ID 6
G.b	Medium Room ID 3
H	Medium Room ID accommodates insert 1
I	Large Room ID accommodates insert 2
J	Large Room ID accommodates insert 3
K	Large Room ID accommodates insert 1
M	Large Flag Mount 1
N.3	Maximum Occupancy 3
P.1	Vinyl Numbers 1
SF	Fire Control Panel 1



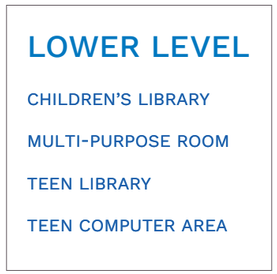
2.3 INTERIOR SIGNAGE DRAWINGS
ADA SIGNAGE

Direct Print Face
A .187NG, .187 White
Colors: White

Direct Print Copy
B Print **PMS** 2935C
Font: Work Sans Semibold

Raised Copy
C Paint **PMS** 2935C
Font: ADA Work Sans

Direct Print Logo
D Artwork: Use on Rendering
Colors:**PMS** 2935C



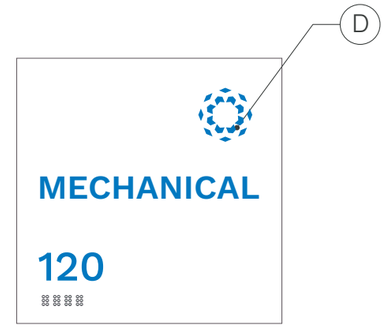
Type A.6 VV1AW-014014
7.0"w X 7.0"h



Type EL V1AH11
5.0"w X 5.0"h



Type E.4 VV1AW-014014
7.0"w X 7.0"h



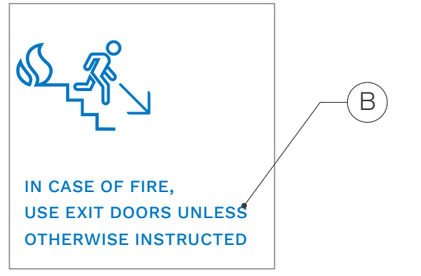
Type G.b VV1AW-014014
7.0"w X 7.0"h



Type A.6
Alternate Layout



Type E.2 VV1AW-014014
7.0"w X 7.0"h

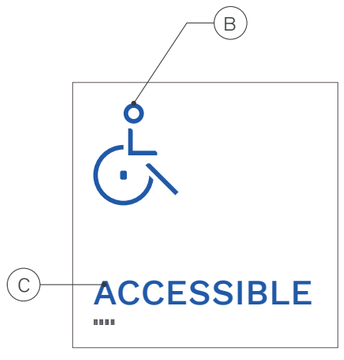


Type E.4
Alternate Layout



Type G.b
Alternate Layout

GET ACCESSIBLE SIGN DIRECTIONAL



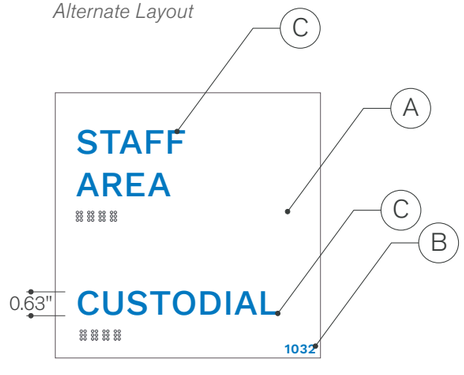
Type RPWM-B VV1AW-014014
7.0"w X 7.0"h



Type E VV1AW-014014
7.0"w X 7.0"h



Type E.2
Alternate Layout



Type G VV1AW-014014
7.0"w X 7.0"h



Type G.c VV1AW-014014
7.0"w X 7.0"h

2.3 INTERIOR SIGNAGE DRAWINGS

ADA SIGNAGE

Direct Print Face

A — .187NG, .187 White
Colors: White

Direct Print Copy

B — Print **PMS** 2935C
Font: Work Sans Semibold

Raised Copy

C — Paint **PMS** 2935C
Font: ADA Work Sans

Insert

D — Media: White Polyester;
Font: Replica Pro Regular
Graphics/Copy Color: **PMS** 2935C

Direct Print Face

E — .187NG, .187 White
Colors: Poinsettia

Direct Print Copy

F — White
Font: Work Sans Semibold



Type H VV1AW-01401401-T12H01
7.0"w X 7.0"h
with thumbnotch in back

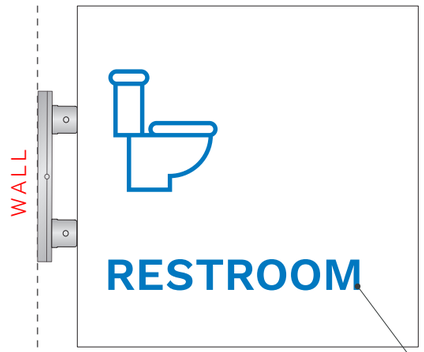


Type I VV1AW-01802001-T16M01
9.0"w X 10.0"h
with thumbnotch in back



Type K VV1AW-01802001-T16M01
9.0"w X 10.0"h
with thumbnotch in back

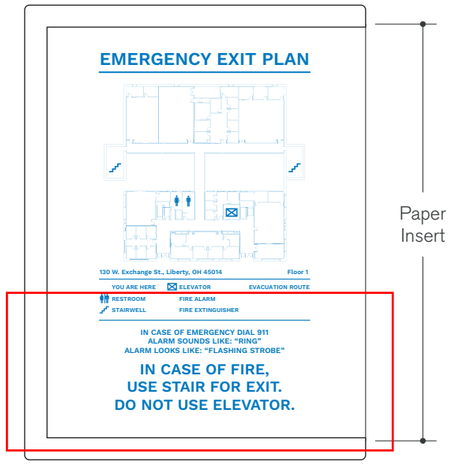
side one



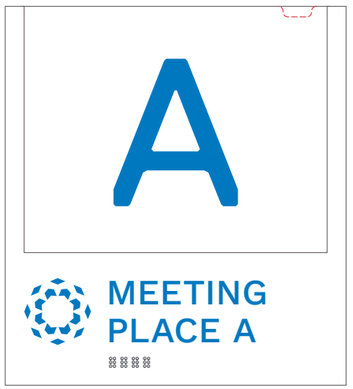
Type M VV1AF-018018
9.0"w X 9.0"h
Double Sided



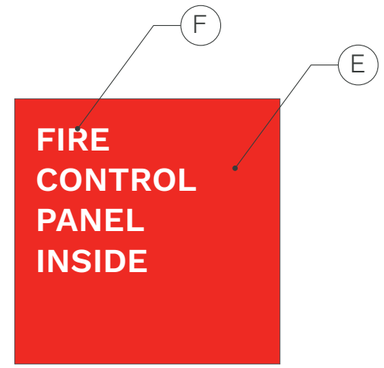
Type N.3 VV1AW-010010
5.0"w X 5.0"h



Type O V1AH38
9.0"w X 12.0"h
Accommodates Insert

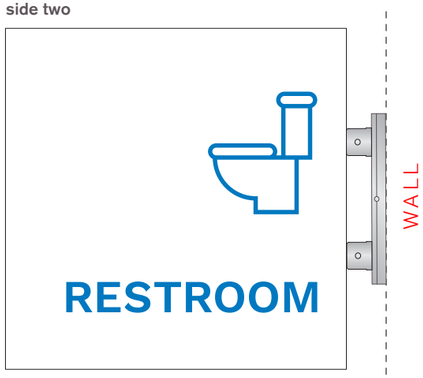


Type J VV1AW-01802001-T16M01
9.0"w X 10.0"h
with thumbnotch in back



Type SF VV1AW-014014
7.0"w X 7.0"h

side two



2.3 INTERIOR SIGNAGE DRAWINGS

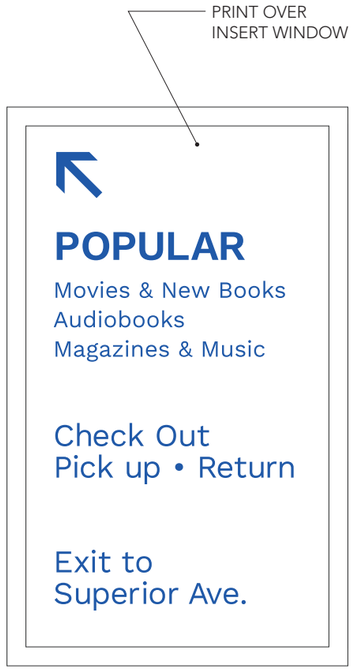
DIRECTIONAL SIGNAGE

Direct Print Face

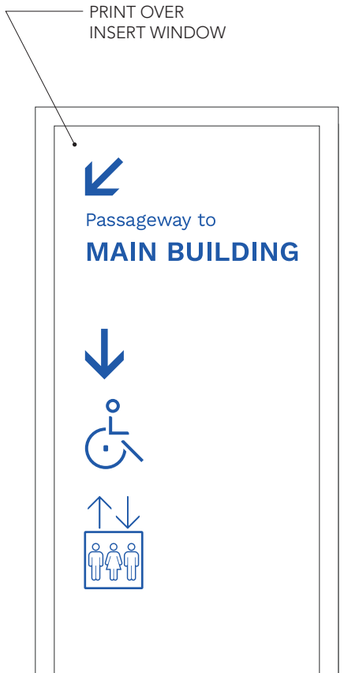
A .187NG, .187 White
Colors: White

Direct Print Copy

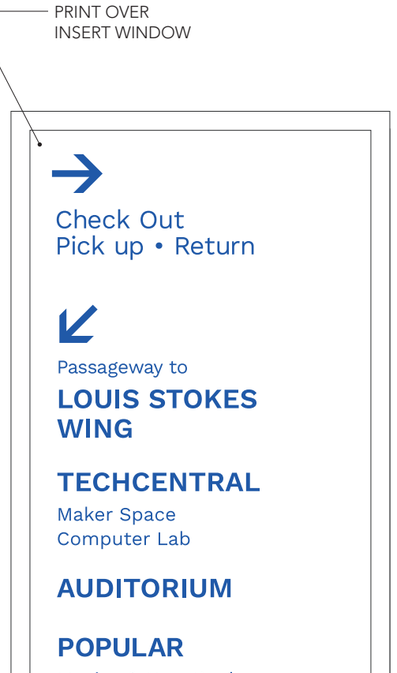
B Print **PMS** 2935C
Font: Work Sans Semibold



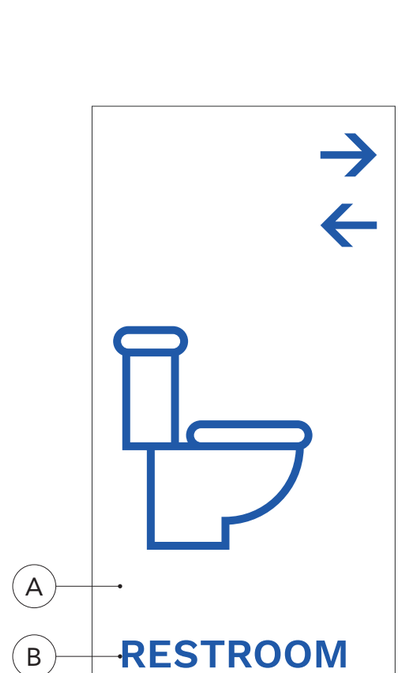
Type DCL-B
VV1AW-03605902-R34BG01
18.0"w X 29.5"h
Accommodates Insert



Type DCL-C
VV1AW-03206402-R30BM01
16.0"w X 32.0"h
Accommodates Insert



Type DCL-D
VV1AW-04007202-R38BV01
20.0"w X 36.0"h
Accommodates Insert



Type RRWM-A VV1AW-032064
16.0"w X 32.0"h

NOT FINAL

2.3 INTERIOR SIGNAGE DRAWINGS

DIRECTORY SIGNAGE

Direct Print Background

A White

Insert

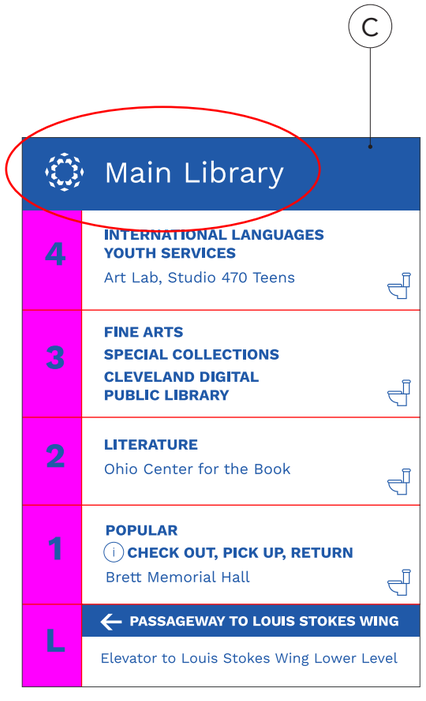
B White Polyester
PMS 2935C
Font: Work Sans Semibold, Regular

Cabinet Insert

C Media: TBD
Font: Work Sans Regular, Bold
Graphics/Copy Color: White, PMS 2935C
PMS Cool Gray 1C, PMS Cool Gray 3C
Image: TBD

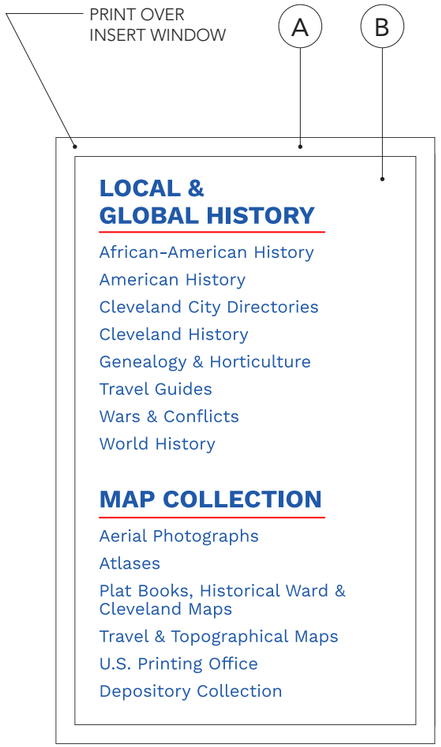


Type DIR-A insert only
20.75"w X 46.5"h

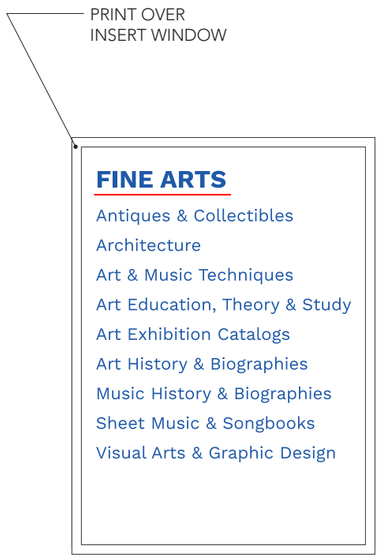


Type DIR-D insert only
21.0"w X 29.0"h

NOT FINAL



Type DIR-B
VV1AW-04006402-R38BM01
20.0"w X 32.0"h
Accommodates Insert



Type DIR-C
VV1AW-03204401-P32AS01
16.0"w X 22.0"h
Accommodates Insert

2.3 INTERIOR SIGNAGE DRAWINGS

FLAG MOUNTED SIGNAGE

Direct Print Background

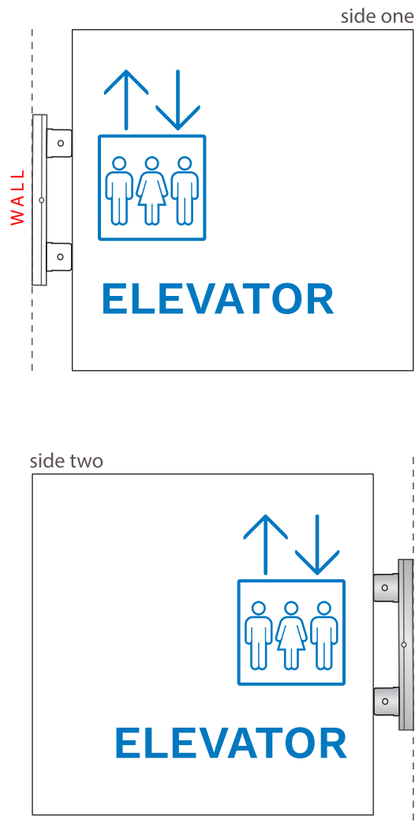
A White

Direct Print Copy/Graphic

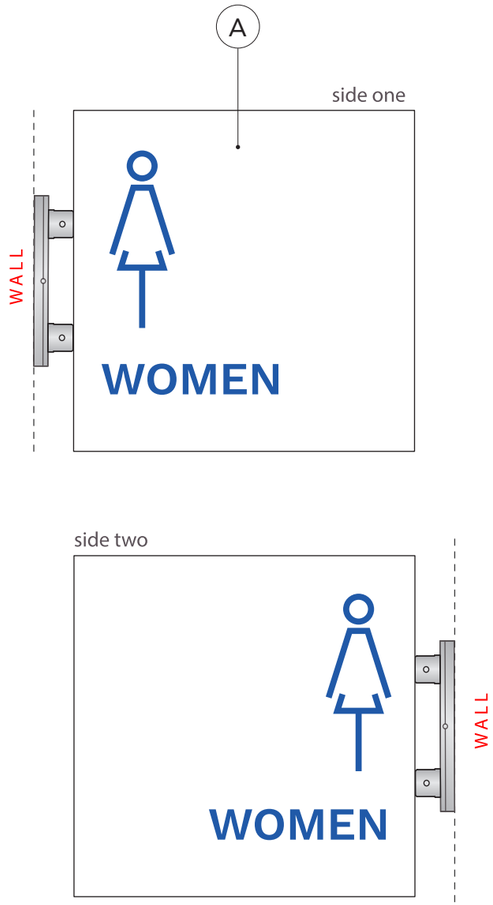
B PMS 2935C
Font: Work Sans Semibold
Work Sans Medium (ADA)

Raised Copy

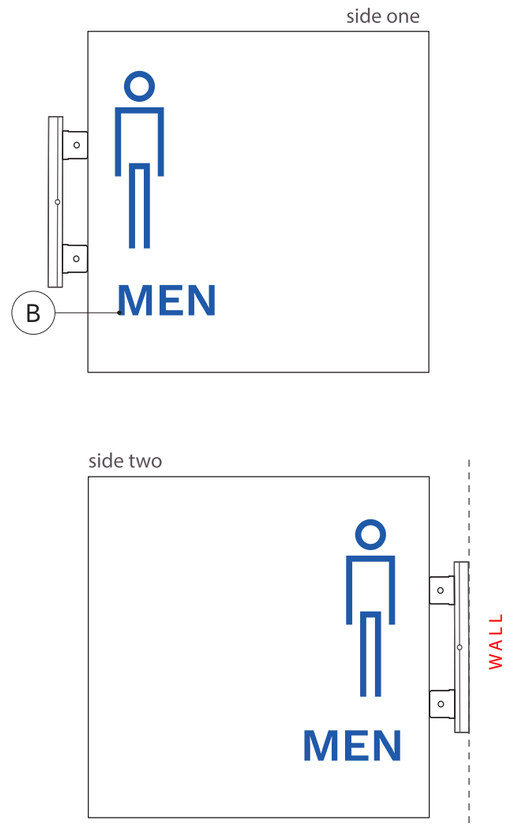
C Paint PMS 2935C
Font: ADA Work Sans



Type ELEV-A VV1AF-018018
9.0"w X 9.0"h
Double Sided



Type RRFL VV1AF-018018
9.0"w X 9.0"h
Double Sided



Type RRFL VV1AF-018018
9.0"w X 9.0"h
Double Sided

2.3 INTERIOR SIGNAGE DRAWINGS

CEILING MOUNTED OVERHEAD SIGNAGE

Direct Print Background

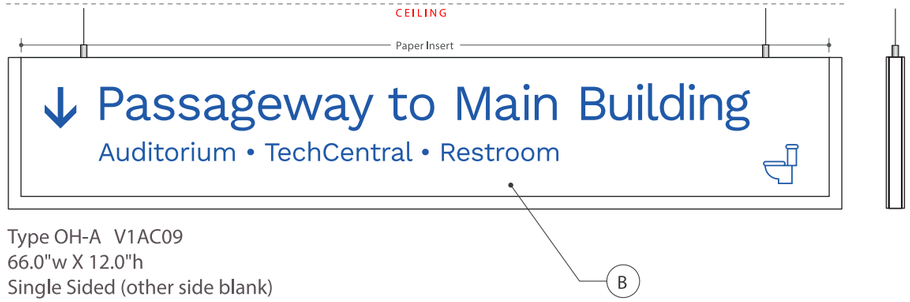
A White

Insert

B White Polyester
PMS 2935C
Font: Work Sans Regular

Direct Print Copy/Graphic

C Print PMS 2935C
Font: Work Sans Semibold



Type OH-A V1AC09
66.0"w X 12.0"h
Single Sided (other side blank)
Accommodates Insert



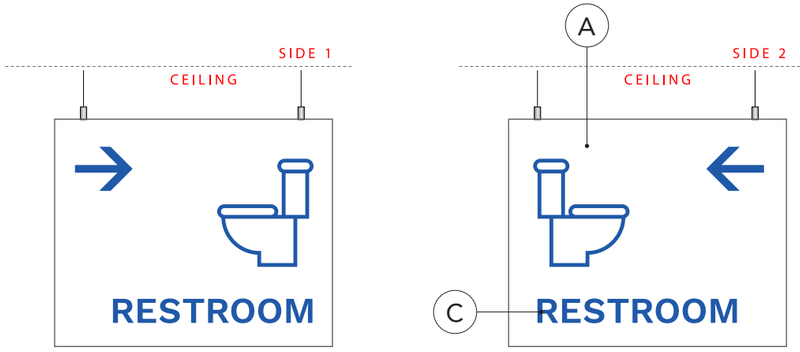
Type OH-C V1AC09
66.0"w X 12.0"h
Single Sided (other side blank)
Accommodates Insert



Type OH-B V1AC09
66.0"w X 12.0"h
Double Sided
Accommodates Insert



Type OH-B V1AC09



Type RROH VV1AV-044036
22.0"w X 18.0"h
Double Sided

2.3 INTERIOR SIGNAGE DRAWINGS

DIRECTIONAL SIGN PLAQUES

Direct Print Background

A White

Insert

B White Polyester
Artwork: Use on Rendering
PMS 2935C
Font: Work Sans Semibold, Regular



Type DCL-A
VV1AW-03603601-P36AJ01
18.0"w X 18.0"h
Accommodates Insert



Type DCL-A



Type DCL-A



Type DCL-A



Type DCL-A



Type DCL-A



Type DCL-A

2.3 INTERIOR SIGNAGE DRAWINGS
FREESTANDING PILLARS

Direct Print Background

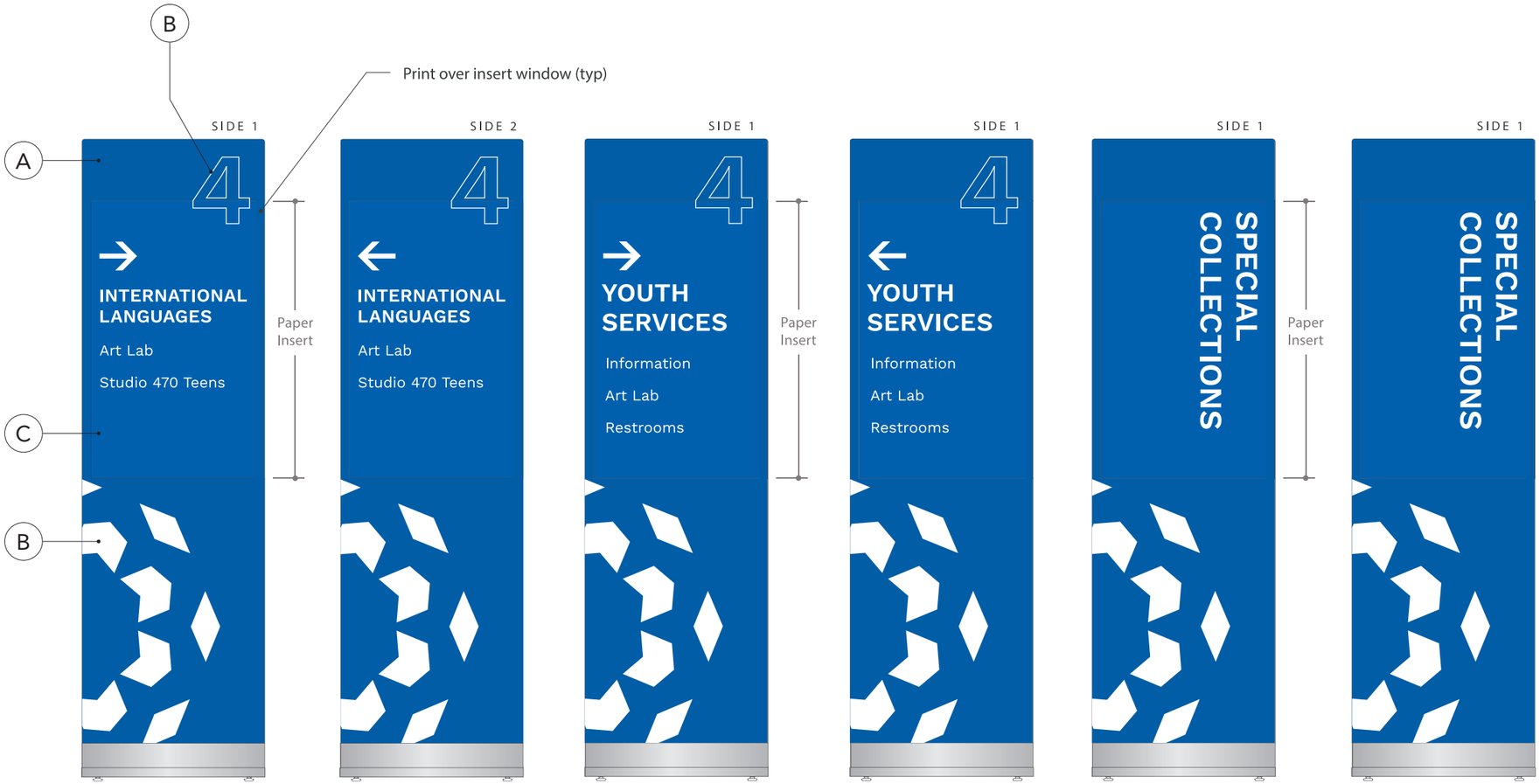
A PMS 2935C

Direct Print Copy/Graphic

B Color: White
Font: Work Sans Semibold

Insert

C White Polyester Printed PMS 2935C
Copy Color: White
Font: Work Sans Regular, Semibold



Type PIL-A VK22_F1_F1
22.17"w X 77.50"h
Double Sided
Accommodates Insert

Type PIL-A

Type PIL-B VK22_F1_F1
22.17"w X 77.50"h
Double Sided
Accommodates Insert

Type PIL-B

Type PIL-C VK22_F1_F1
22.17"w X 77.50"h
Double Sided
Accommodates Insert

Type PIL-C

NOT FINAL

2.3 INTERIOR SIGNAGE DRAWINGS
FLOOR INDICATORS

Direct Print Background

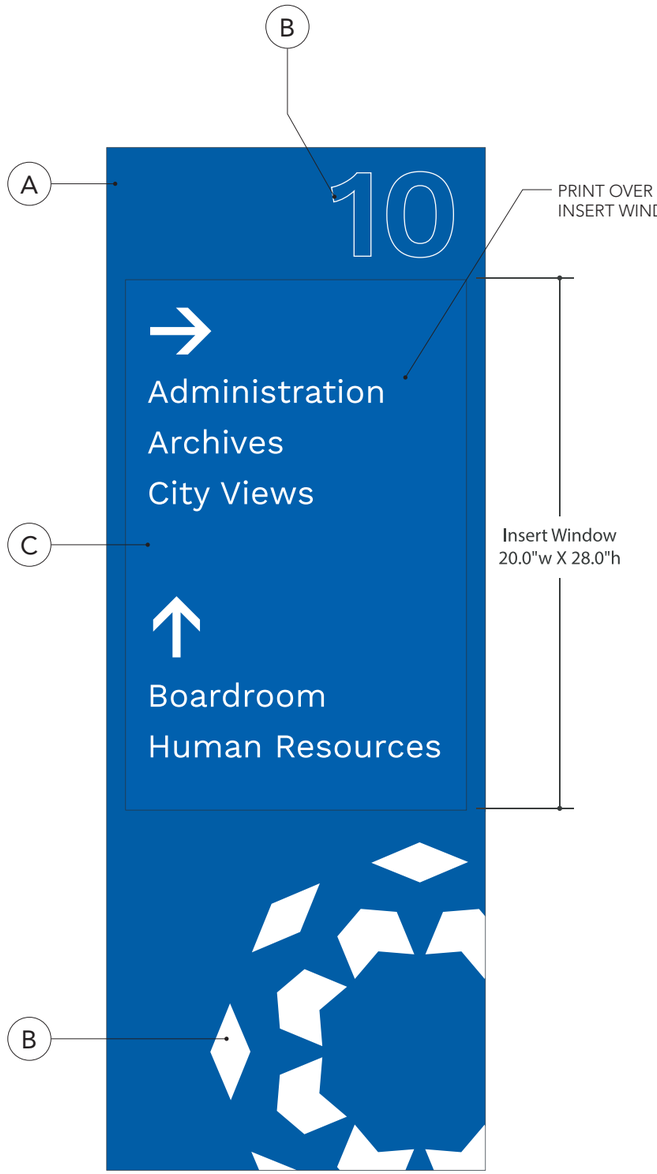
A PMS 2935C

Direct Print Copy/Graphic

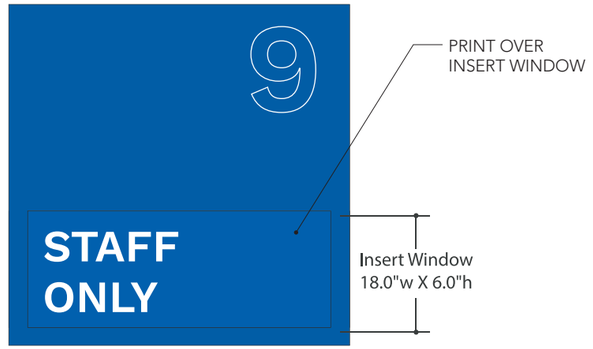
B Color: White
Font: Work Sans Semibold

Insert

C White Polyester Printed PMS 2935C
Copy Color: White
Font: Work Sans Regular, Semibold



Type FLID-A
VV1AW-04010814-R38BH01
20.0"w X 54.0"h
Accommodates Insert

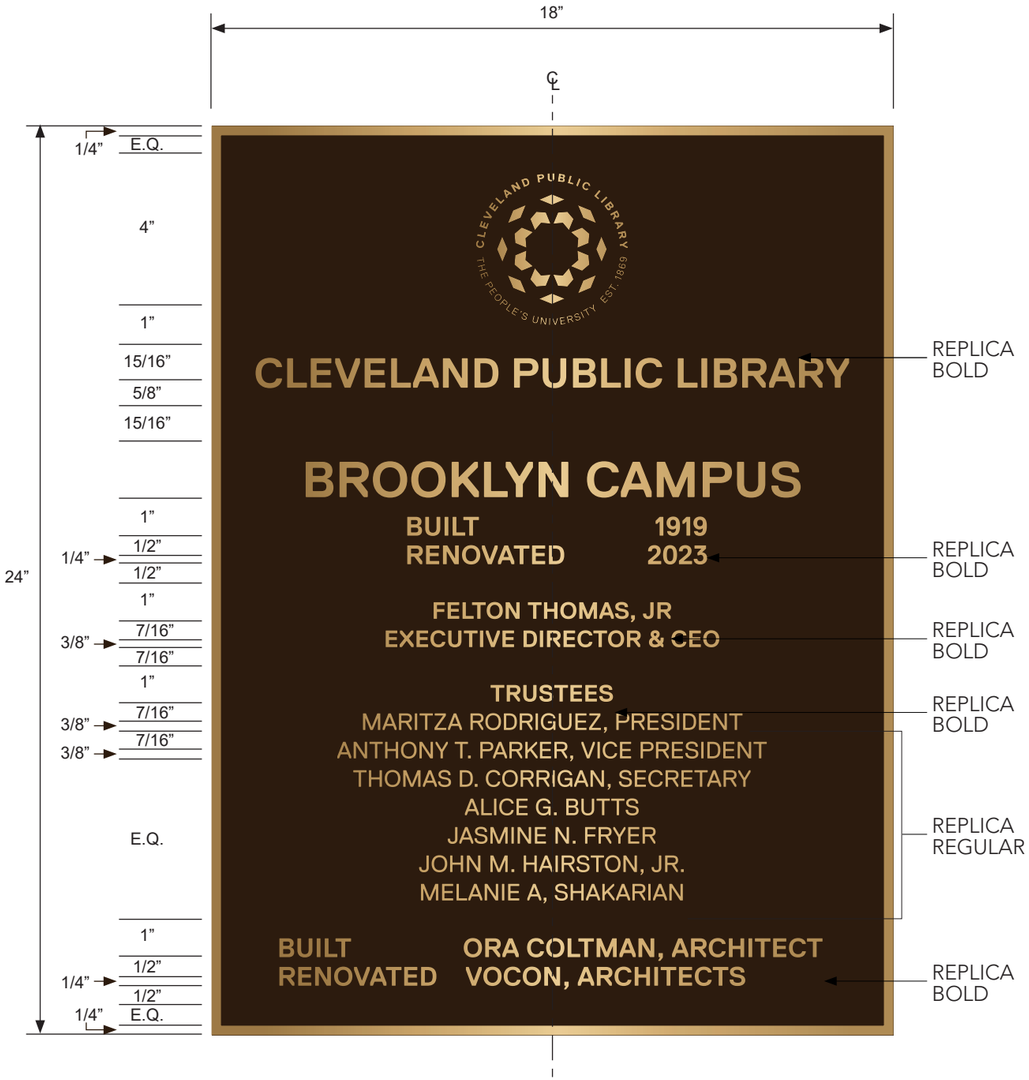


Type FLID-B
VV1AW-03603622-P36L01
18.0"w X 18.0"h
Accommodates Insert

2.3 INTERIOR SIGNAGE DRAWINGS

DEDICATION PLAQUE

Each building should feature a dedication plaque placed on the nearest adjacent wall to the main entry. The plaque must follow the standard layout shown here and comply with the specified fonts and colors. Prior to fabrication, the plaque design must be reviewed and approved by both the CPL Marketing Department and the designated Design Team representative to ensure accuracy of all information.



CAST PLAQUE

MATERIAL	- BRONZE
SIZE	- 18"w x 24"h
QTY	- 1
DEPTH	- Painted Edges-1/2"deep Cast
SHAPE	- Rectangle(or Square)
COPY	- Raised Copy-Horizontal Stroke
FINISH	- Leatherette-w/Brushed Surface
BORDER	- Single Line Border
COLOR	- F63R Brown SATIN
STYLE	- Per Artfile Supplied
CLEAR	- Satin
MOUNT	- Blind:Standard Stud
ROSETTES	- No Rosettes Required
PATTERN	- No

RAISED — BRONZE

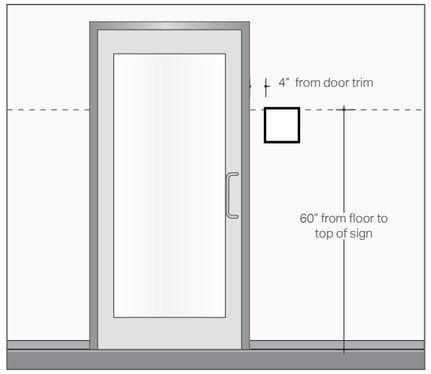
RECESSED — F63R BROWN

CURRENT VENDOR OF RECORD:

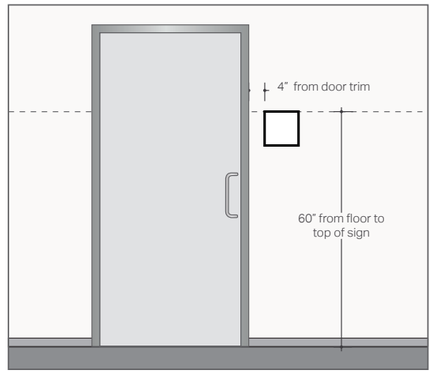
PS AWARDS
9257 MIDWEST AVENUE
CLEVELAND, OH 44125
216-587-1000
SALES@PSAWARDS.COM

2.4 INTERIOR SIGNAGE MOUNTING STANDARDS

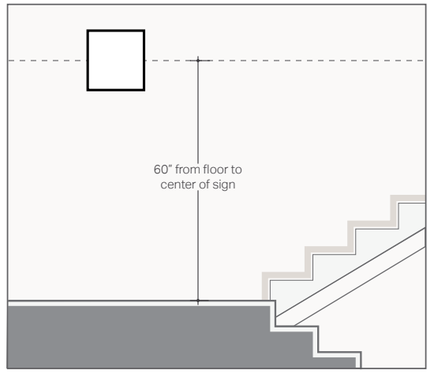
TYPICAL



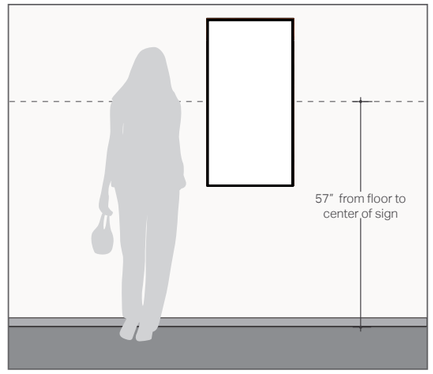
Tactile Wall Mounted Signs:
These guidelines comply with the current Federal Law as published in "2010 ADA Standards for Accessible Design" publication, pgs. 189 – 190. Published September 15, 2010, revised March 1, 2011. For more information: www.ada.gov-/2010ADAstandards_index.htm
703.4.1 Height Above Finish Floor or Ground. Tactile characters on signs shall be located 48 inches (1220 mm) minimum above the finish floor or ground surface, measured from the baseline of the lowest tactile character and 60 inches (1525 mm) maximum above the finish floor or ground surface, measured from the baseline of the highest tactile character.
EXCEPTION: Tactile characters for elevator car controls shall not be required to comply with 703.4.1.
NOTE: When visual sign field is utilized, the visual field will have a mounting height of 40 inches minimum.
703.4.2 Location. Where a tactile sign is provided at a door, the sign shall be located alongside the door at the latch side. Where a tactile sign is provided at double doors with one active leaf, the sign shall be located on the inactive leaf. Where a tactile sign is provided at double doors with two active leafs, the sign shall be located to the right of the right hand door. Where there is no wall space at the latch side of a single door or at the right side of double doors, signs shall be located on the nearest adjacent wall. Signs containing tactile characters shall be located so that a clear floor space of 18 inches (455 mm) minimum by 18 inches (455 mm) minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position.
EXCEPTION: Signs with tactile characters shall be permitted on the push side of doors with closers and without hold-open devices.
Takeform Standard: Signs that have a permanent room identifier shall be mounted 60" above finished floor to the top of the sign. This is an interpretation of the Accessibility Guidelines.



Tactile Wall Mounted Restroom Signs:
These guidelines comply with the current Federal Law as published in "2010 ADA Standards for Accessible Design" publication, pgs. 189 – 190. Published September 15, 2010, revised March 1, 2011. For more information: www.ada.gov-/2010ADAstandards_index.htm
703.4.1 Height Above Finish Floor or Ground. Tactile characters on signs shall be located 48 inches (1220 mm) minimum above the finish floor or ground surface, measured from the baseline of the lowest tactile character and 60 inches (1525 mm) maximum above the finish floor or ground surface, measured from the baseline of the highest tactile character.
EXCEPTION: Tactile characters for elevator car controls shall not be required to comply with 703.4.1.
NOTE: When visual sign field is utilized, the visual field will have a mounting height of 40 inches Minimum.
703.4.2 Location. Where a tactile sign is provided at a door, the sign shall be located alongside the door at the latch side. Where a tactile sign is provided at double doors with one active leaf, the sign shall be located on the inactive leaf. Where a tactile sign is provided at double doors with two active leafs, the sign shall be located to the right of the right hand door. Where there is no wall space at the latch side of a single door or at the right side of double doors, signs shall be located on the nearest adjacent wall. Signs containing tactile characters shall be located so that a clear floor space of 18 inches (455 mm) minimum by 18 inches (455 mm) minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position.
EXCEPTION: Signs with tactile characters shall be permitted on the push side of doors with closers and without hold-open devices.
Takeform Standard: Signs for Restrooms shall be mounted 60" above finished floor to the top of the sign. This is an interpretation of the Accessibility Guidelines.



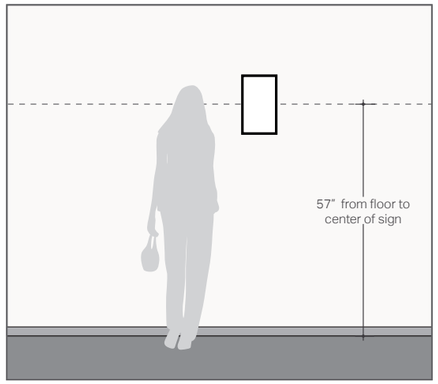
Interior Stair ID Signs:
These guidelines are derived from NFPA 101, 2009, pg. 101 - 58.
7.2.2.5.4 Stair Identification
7.2.2.5.4.1 New enclosed stairs serving three or more stories and existing enclosed stairs serving five or more stories shall comply with 7.2.2.5.4.1 (A) through (M). **(A)** The stairs shall be provided with special signage within the enclosure at each floor landing. **(B)** The signage shall indicate the floor level. **(C)** The signage shall indicate the terminus of the top and bottom of the stair enclosure. **(D)** The signage shall indicate the identification of the stair enclosure. **(E)** The signage shall indicate the floor level of, and the direction to, exit discharge. **(F)** The signage shall be located inside the enclosure approximately 60 in. (1525 mm) above the floor landing in a position that is visible when the door is in the open or closed position. **(G)** The signage shall comply with 7.10.8.1 and 7.10.8.2 of this Code. **(H)** The floor level designation shall also be tactile in accordance with ICC/ANSI A117.1, *American National Standard for Accessible and Usable Buildings and Facilities*. **(I)** The signage shall be painted or stenciled on the wall or on a separate sign securely attached to the wall. **(J)** The stairway identification letter shall be located at the top of the sign in minimum 1 in. (25mm) high lettering and shall be in accordance with 7.10.8.2. **(K)** Signage that reads NO ROOF ACCESS and is located under the stairway identification letter shall designate stairways that do not provide roof access. Lettering shall be a minimum of 1 in. (25mm) high and shall be in accordance with 7.10.8.2 **(L)** The floor level number shall be located in the middle of the sign in minimum 5 in. (125 mm) high numbers and shall be in accordance with 7.10.8.2. Mezzanine levels shall have the letter "M" or other appropriate identification letter preceding the floor number, while basement levels shall have the letter "B" or the appropriate identification letter preceding the floor level number. **(M)** Identification of the lower and upper terminus of the stairway shall be located at the bottom of the sign in minimum 1 in. (25 mm) high letters or numbers and shall be in accordance with 7.10.8.2.
7.2.2.5.4.2 Wherever an enclosed stair requires travel in an upward direction to reach the level of exit discharge, special signs with directional indicators showing the direction to the level of exit discharge shall be provided at each floor level landing from which upward direction of travel is required, unless otherwise provided in 7.2.2.5.4.2 (A) and 7.2.2.5.4.2 (B), and the following also shall apply: **(1)** Such signage shall comply with 7.10.8.1 and 7.10.8.2. **(2)** Such signage shall be visible when the door leaf is in the open or closed position. **(A)** The requirement of 7.2.2.5.4.2 shall not apply where signs required by 7.2.2.5.4.1 are provided. **(B)** The requirement of 7.2.2.5.4.2 shall not apply to stairs extending not more than one story below the level of exit discharge where the exit discharge is clearly obvious.
Takeform Standard: Follows 7.2.2.5.4.1 section (F) for mounting heights.



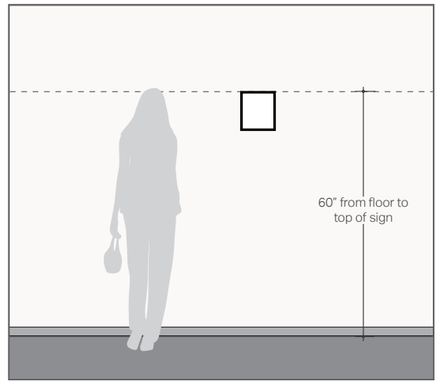
Directories:
These guidelines comply with the current Federal Law as published in "2010 ADA Standards for Accessible Design" publication, pg. 71.
216.1 General. Signs shall be provided in accordance with 216 and shall comply with 703.
EXCEPTIONS: 1. Building directories, menus, seat and row designations in assembly areas, occupant names, building addresses, and company names and logos shall not be required to comply with 216.
703.5 Visual Characters. Visual characters shall comply with 703.5.
EXCEPTION: Where visual characters comply with 703.2 and are accompanied by braille complying with 703.3, they shall not be required to comply with 703.5.2 through 703.5.9.
703.5.6 Height From Finish Floor or Ground. Visual characters shall be 40 inches (1015 mm) minimum above the finish floor or ground.
Takeform Standard: Signs over 14" with no Braille shall be mounted 57" above finished floor to the center of the sign. This is an interpretation of the Accessibility Guidelines.

2.4 INTERIOR SIGNAGE MOUNTING STANDARDS

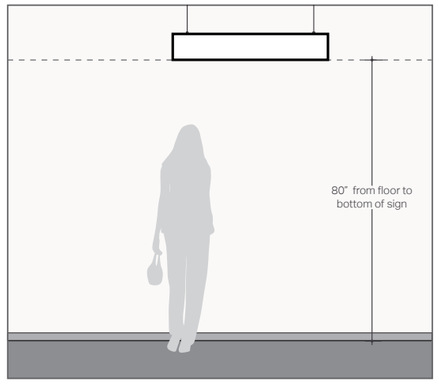
TYPICAL



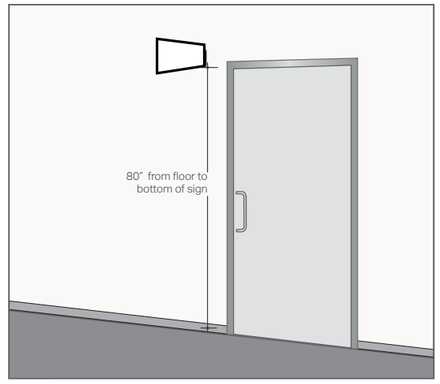
Visual Wall Mounted Signs/Evacuation Maps (Greater Than 14" High):
These guidelines comply with the current Federal Law as published in "2010 ADA Standards for Accessible Design" publication, pg. 71.
216.1 General. Signs shall be provided in accordance with 216 and shall comply with 703.
EXCEPTIONS: 1. Building directories, menus, seat and row designations in assembly areas, occupant names, building addresses, and company names and logos shall not be required to comply with 216. 703.5 Visual Characters. Visual characters shall comply with 703.5.
EXCEPTION: Where visual characters comply with 703.2 and are accompanied by braille complying with 703.3, they shall not be required to comply with 703.5.2 through 703.5.9. 703.5.6 Height From Finish Floor or Ground. Visual characters shall be 40 inches (1015 mm) minimum above the finish floor or ground.
Takeform Standard: Signs over 14" with no Braille shall be mounted 57" above finished floor to the center of the sign. This is an interpretation of the Accessibility Guidelines.



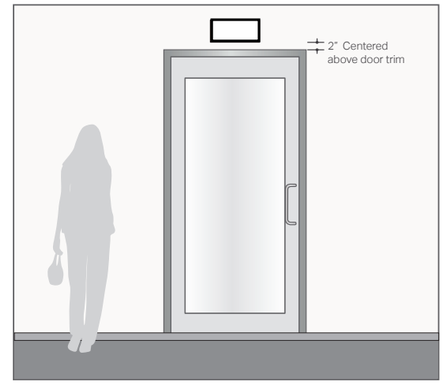
Visual Wall Mounted Signs (Less Than 14" High):
216.1 General. Signs shall be provided in accordance with 216 and shall comply with 703.
EXCEPTIONS: 1. Building directories, menus, seat and row designations in assembly areas, occupant names, building addresses, and company nnames and logos shall not be required to comply with 216. 703.5 Visual Characters. Visual characters shall comply with 703.5.
EXCEPTION: Where visual characters comply with 703.2 and are accompanied by braille complying with 703.3, they shall not be required to comply with 703.5.2 through 703.5.9. 703.5.6 Height From Finish Floor or Ground. Visual characters shall be 40 inches (1015 mm) minimum above the finish floor or ground.
Takeform Standard: Signs less than 14" with no Braille shall be mounted 60" above finished floor to the top of the sign. This is an interpretation of the Accessibility Guidelines.



Overhead Mounted Signs:
307.2 Protrusion Limits.
Objects with leading edges more than 27 inches (685 mm) and not more than 80 inches (2030 mm) above the finish floor or ground shall protrude 4 inches (100 mm) maximum horizontally into the circulation path.
307.3 Post-Mounted Objects.
Free-standing objects mounted on posts or pylons shall overhang circulation paths 12 inches (305 mm) maximum when located 27 inches (685 mm) minimum and 80 inches (2030 mm) maximum above the finish floor or ground. Where a sign or other obstruction is mounted between posts or pylons and the clear distance between the posts or pylons is greater than 12 inches (305 mm), the lowest edge of such sign or obstruction shall be 27 inches (685 mm) maximum or 80 inches (2030 mm) minimum above the finish floor or ground.
307.4 Vertical Clearance.
Vertical clearance shall be 80 inches (2030 mm) high minimum. Guardrails or other barriers shall be provided where the vertical clearance is less than 80 inches (2030 mm) high.
The leading edge of such guardrail or barrier shall be located 27 inches (685 mm) maximum above the finish floor or ground.
Takeform Standard: Follows 307.2 - 307.4 for mounting heights.



Flag Mounted Signs:
307.2 Protrusion Limits.
Objects with leading edges more than 27 inches (685 mm) and not more than 80 inches (2030 mm) above the finish floor or ground shall protrude 4 inches (100 mm) maximum horizontally into the circulation path.
307.3 Post-Mounted Objects.
Free-standing objects mounted on posts or pylons shall overhang circulation paths 12 inches (305 mm) maximum when located 27 inches (685 mm) minimum and 80 inches (2030 mm) maximum above the finish floor or ground. Where a sign or other obstruction is mounted between posts or pylons and the clear distance between the posts or pylons is greater than 12 inches (305 mm), the lowest edge of such sign or obstruction shall be 27 inches (685 mm) maximum or 80 inches (2030 mm) minimum above the finish floor or ground.
307.4 Vertical Clearance.
Vertical clearance shall be 80 inches (2030 mm) high minimum. Guardrails or other barriers shall be provided where the vertical clearance is less than 80 inches (2030 mm) high. The leading edge of such guardrail or barrier shall be located 27 inches (685 mm) maximum above the finish floor or ground.
Takeform Standard: Follows 307.2 - 307.4 for mounting heights.



Maximum Occupancy Signs:

International Building Code, 2009
1004.3 Posting of occupant load. Every room or space that is an assembly occupancy shall have the occupant load of the room or space posted in a conspicuous place, near the main exit or exit access doorway from the room or space. Posted signs shall be of an approved legible permanent design and shall be maintained by the owner or authorized agent.

Takeform Standard:
Every room or space that is an area of assembly shall have the occupant load of the room or space centered above the door, 2" off the door trim, near the main access doorway. Signs shall have 1-inch block letters and numbers on a contrasting background so as to be readily visible. A sign with changeable numbers is not permitted. This is an interpretation of the International Building Code.

2.5 INTERIOR DESTINATION NOMENCLATURE

Code Compliant

Auditorium
Data
Electrical
Elevators
Entry
Event Space
Exit
First Aid
Information
Level
Library Administration
Lobby
Mechanical
Meeting Place
Mens
Privacy Room
Office
Restroom
Shower
Staff Lounge
Stair
Storage
Suite
Tornado Shelter
Vestibules
Waiting
Wellness
Womens
Kitchen

Destinations

3d Printing
Adult Collection
Archives
Auditorium
Book Lockers
Cafe
Campus
Children's Area
Circulation Work Room
Conference Room
Computer Stations
Court Yard
Gallery
Historical Markers
Information
Learning Commons
Mobile Checkout
Print Room
Reading Room
Special Collections
Technology
Teen Collection
Tutoring Room
Youth Services
Vending

Subject Genres

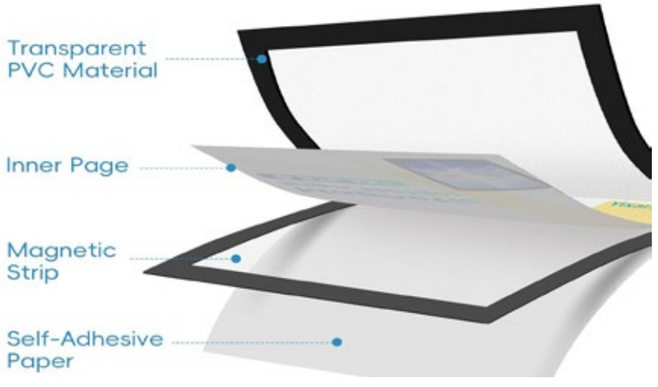
Business
Careers
Finance
History
Travel
Test Guides
Art
Music
Audiobooks
Blu-Ray
Board Books
CD
Comics
DVD
Fiction
First Readers
Large Print
Magazines
Non-fiction
Language
Literature
Cooking
Crafts and Hobbies
Gardening
Health and Wellness
Home Improvement
Science
Education
Legal
Politics
Psychology
Relationships
Religion
Self-Help
Social Sciences
Sports
True Crime

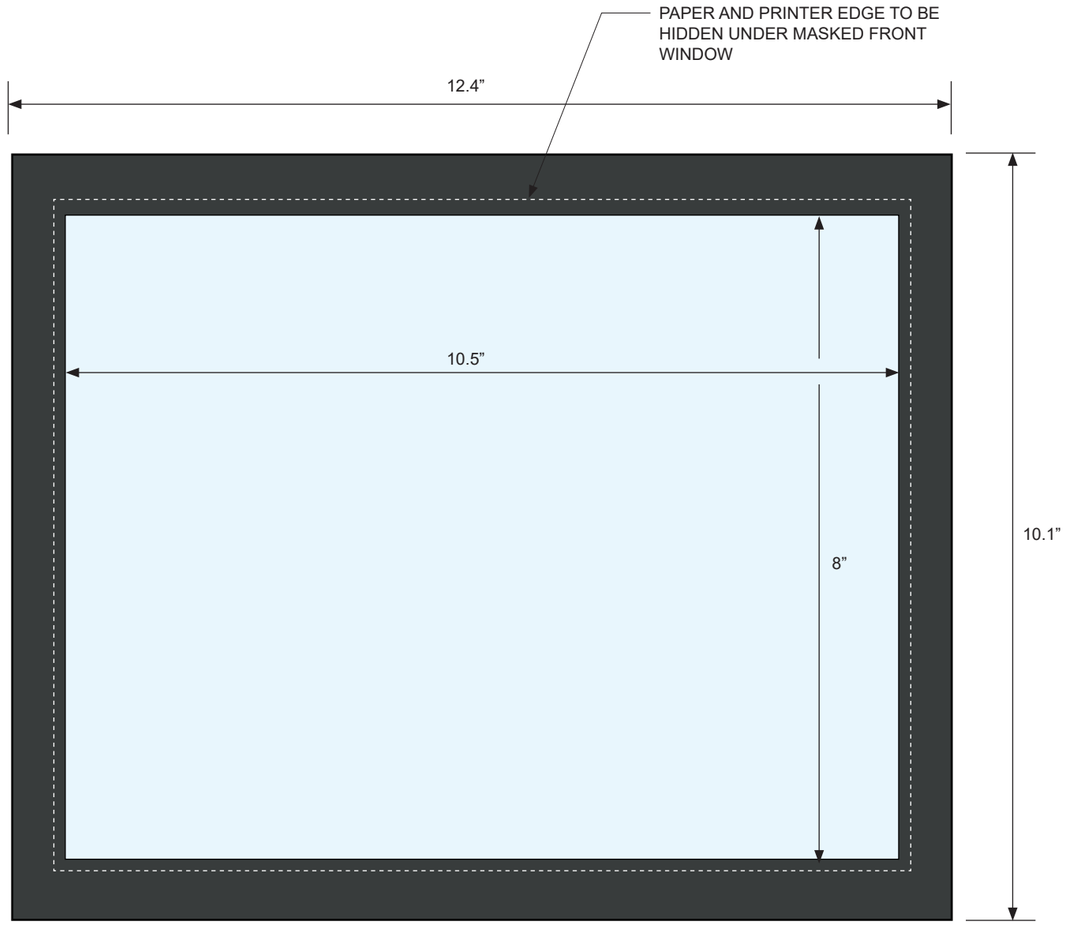
2.6 BOOK SHELF TAGS

BOOK SHELF TAG HOLDERS

Each bookshelf will use two letter-sized document holders to display shelf contents. The holders must be mounted in the specified locations and should meet the following criteria:

1. **Mounting to Metal Shelves:** The back of the display frame must include magnetic strips to allow secure yet easily removable attachment to a metal or magnetic surface.
2. **Mounting to Non-Metal Surfaces:** The back of the display frame must include adhesive strips to allow secure attachment to non-metal or non-magnetic surfaces.
3. **Front Appearance:** The clear PVC front surface must include a black-painted or applied frame edge to conceal the magnetic or adhesive fastening, ensuring a clean and professional appearance.
4. **Product Procurement:** Numerous commercially available products meet these criteria. If procured by an architect, fabricator, or any non-CPL entity, the intended product must be submitted to the CPL design team for review and approval prior to purchase or installation.





MAGNETIC SIGN HOLDER (STANDARD EXAMPLE)

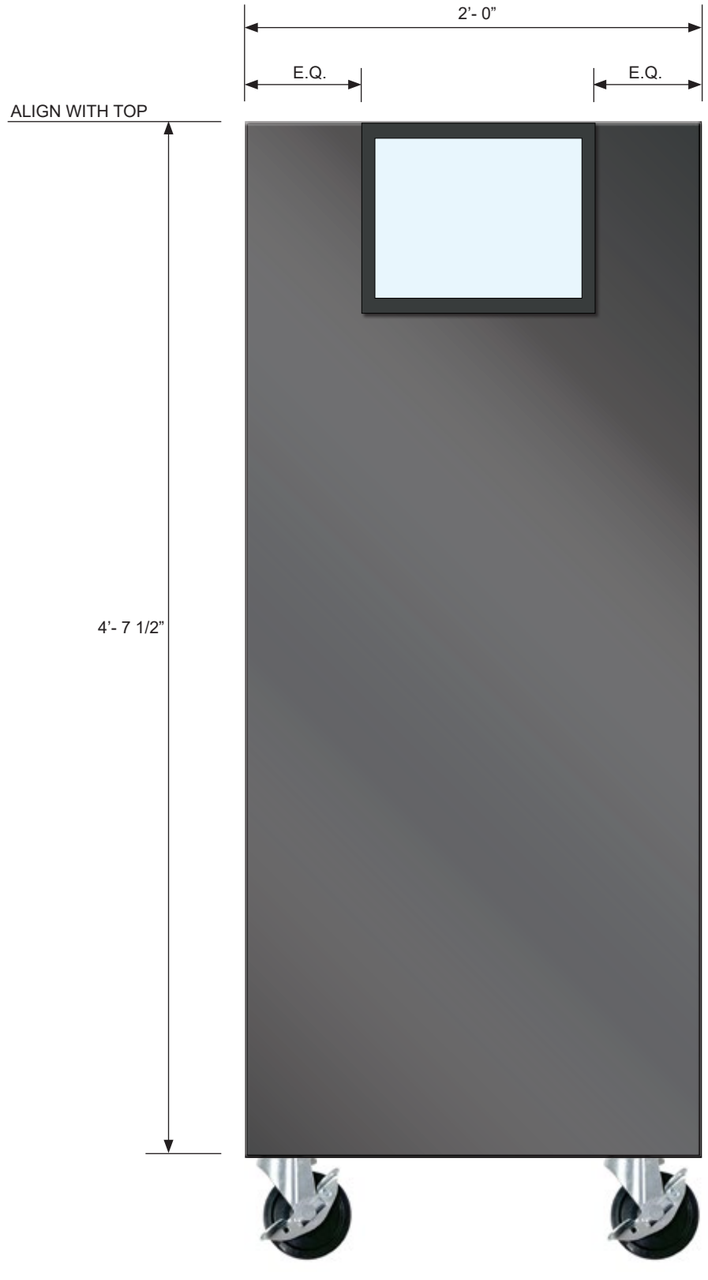
INSERT LAYOUTS

Printed layouts for the inserts must follow the CPL-provided template. The template may be modified only as needed to align with the specific holder shelving system used. CPL staff must use the official template file when creating inserts and should not create new layouts outside the approved system.

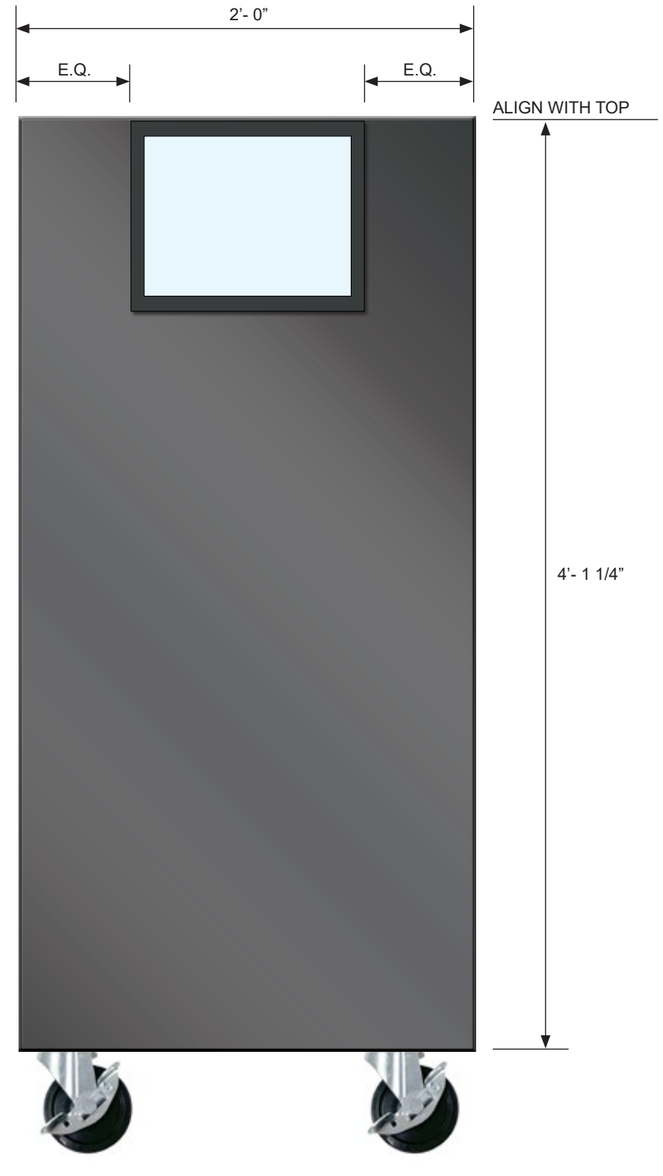
2.6 BOOK SHELF TAGS

BOOK SHELF TAG MOUNTING

Each bookshelf will use two letter-sized document holders to display shelf contents. The holders must be mounted in the specified locations as shown. CPL Campus staff will print the necessary inserts per shelf utilizing the shelf content template.



TALL BOOK SHELF (TYPICAL)
SCALE: 1 1/2" =1'-0"



SHORT BOOK SHELF (TYPICAL)
SCALE: 1"=1'-0"

2.7 BOOK SHELF ICONS

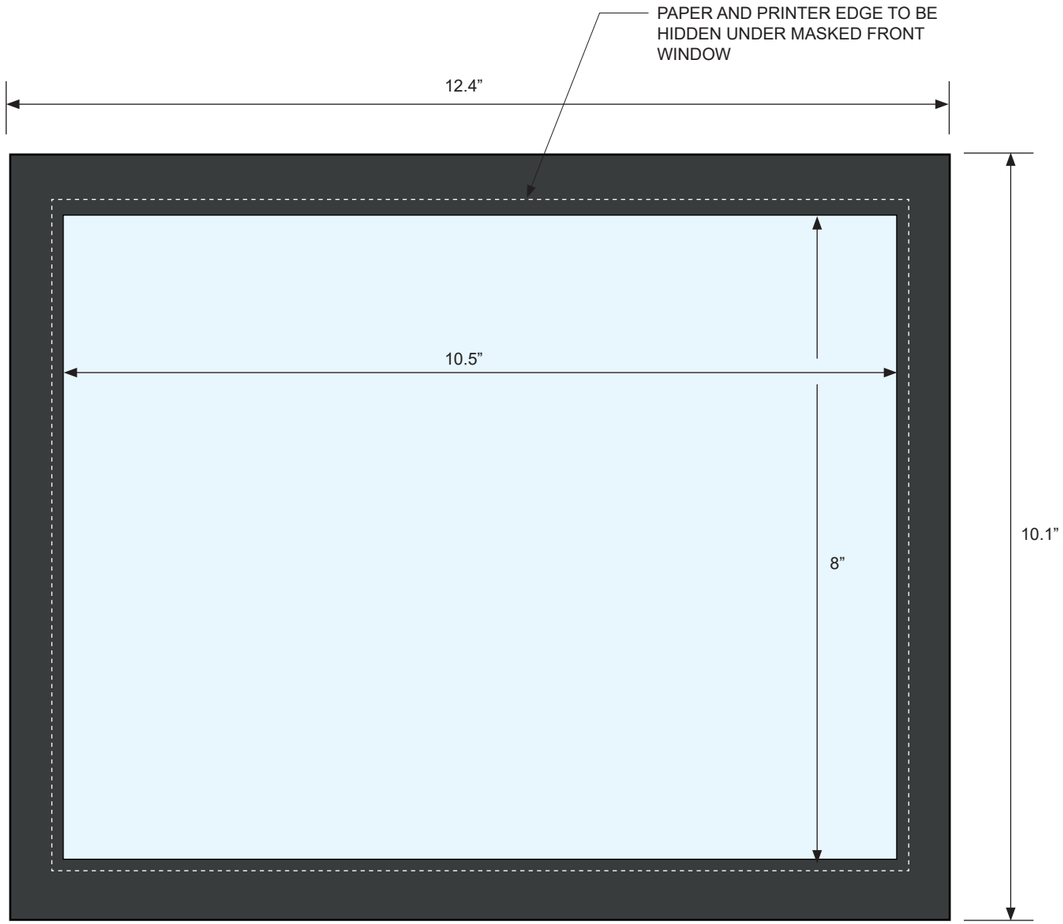
BOOK SHELF ICONS & HOLDERS

At the discretion of the Campus Manager, bookshelves may use the same letter-sized document holders specified for shelf tags to also display shelf icons. These icons provide a clear visual reference to the shelf's content category.

1. **Tall Shelves:** May display a maximum of four (4) icons per side.
2. **Short Shelves:** May display a maximum of three (3) icons per side.
3. **Consistency:** Shelf icons must follow the approved CPL graphic templates and should not be custom-designed outside the provided system.
4. **Placement:** Icons must be mounted in designated holder locations to maintain consistency and legibility across all campuses.

INSERT LAYOUTS

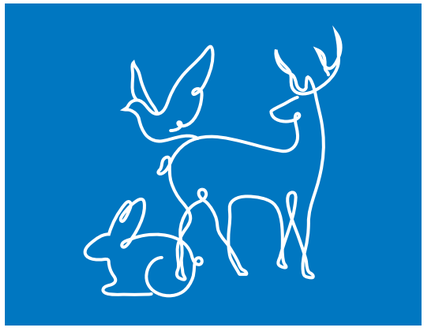
Printed layouts for the inserts must follow the CPL-provided template. The template may be modified only as needed to align with the specific shelving holder system used. CPL staff must use the official template file when creating inserts and should not create new layouts outside the approved system.



MAGNETIC SIGN HOLDER (STANDARD EXAMPLE)

2.7 BOOK SHELF ICONS

BOOK SHELF ICONS GRAPHICS



ANIMALS

Dinosaurs
Farm
Insects
Marine
Pets
Zoo
Reptiles
Birds



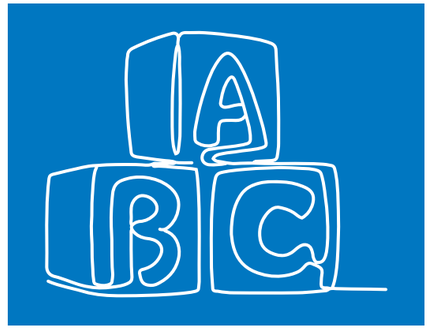
CELEBRATIONS

Birthdays
Holidays
Parties



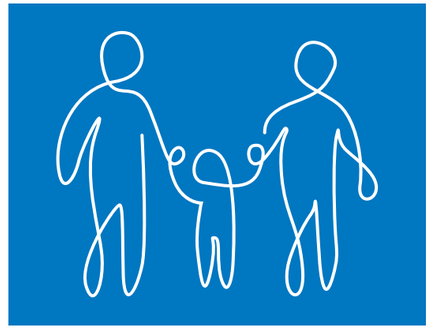
COMMUNITY

Friends
Helpers
Neighborhood
Inclusion



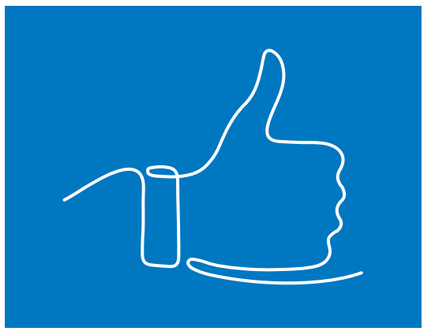
CONCEPTS

Colors
Letters
Shapes Numbers



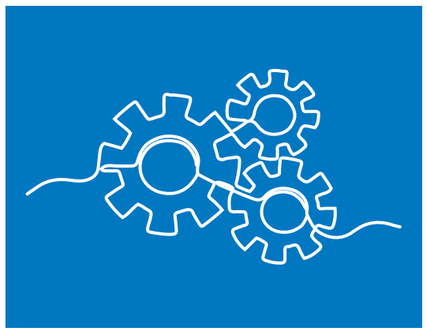
FAMILY

Diversity
Blended
Extended
Same Gender



POPULAR

Classics
Disney
Seuss
Superheroes
Pop culture



LIFE SKILLS

Feelings
Emotions
Growing Up
Social skills

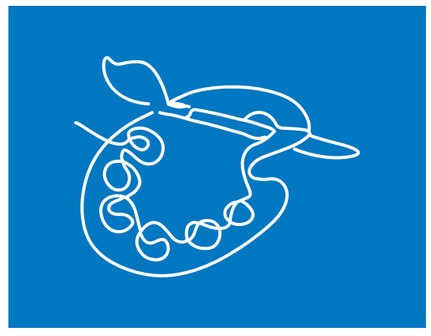


AUDIO BOOKS



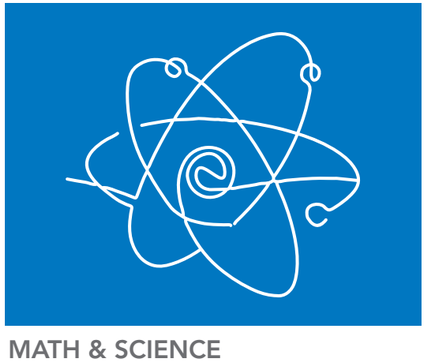
HEALTH

Wellness
Exercise
Sports
Fitness
Medical
Nutrition



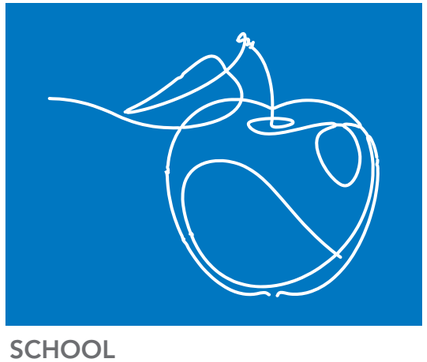
ART

Music
Poetry
Fine Art
Dance
Arts & Crafts



MATH & SCIENCE

Nature
Space
Math
Science



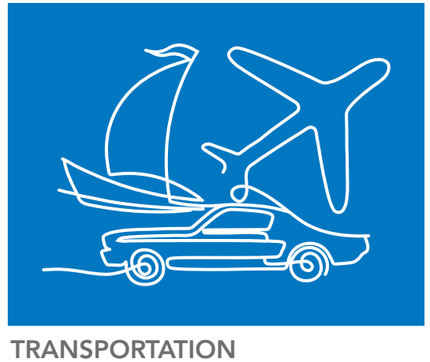
SCHOOL

Kindergarten
Elementary
Middle school
Teachers
Subjects
Clubs



FANTASY

Bedtime Stories
Folk Tales
Lullabies
Magic



TRANSPORTATION

Cars
Bicycles
Trains
Buses
Airplanes
Boats/Ships
First responder

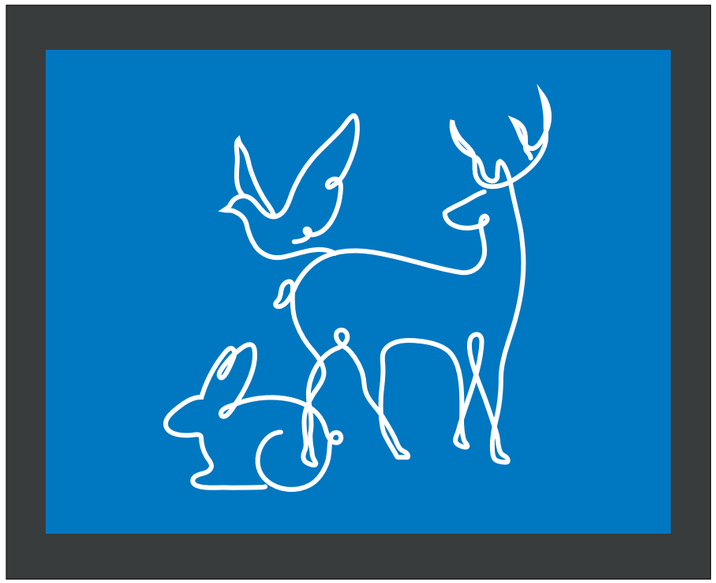


WORLD

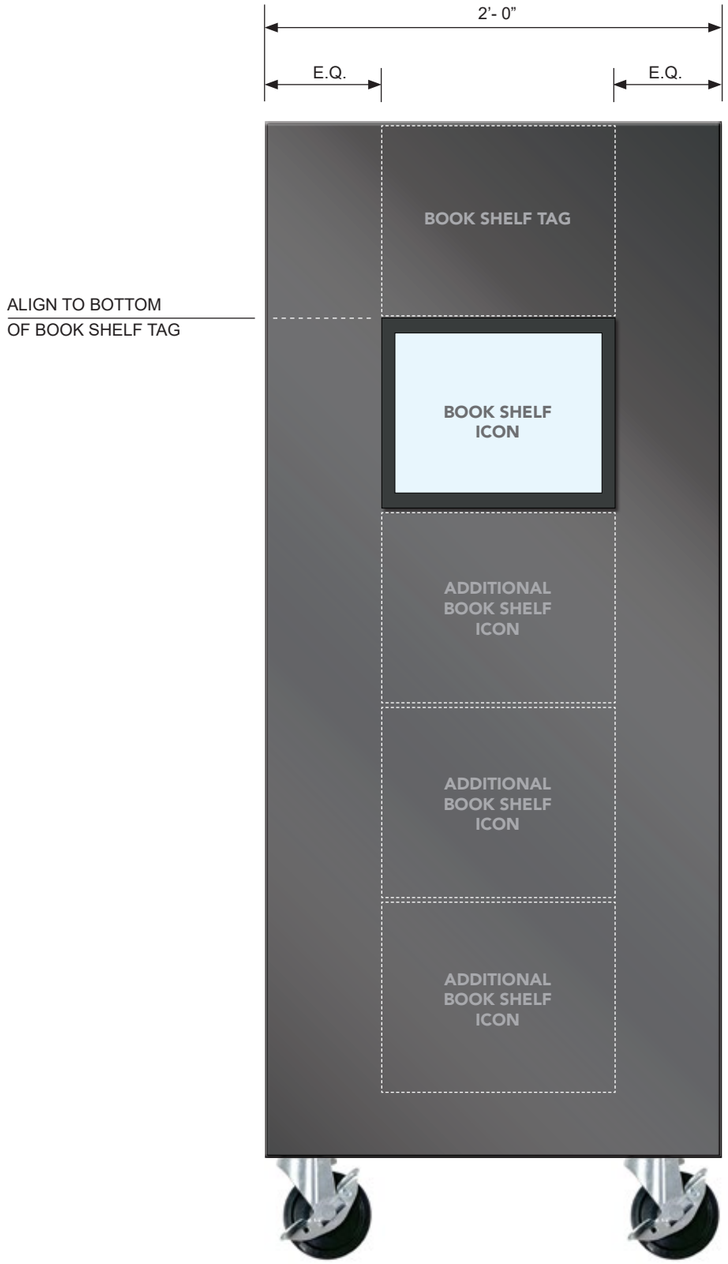
Geography
Travel
Cultures
History
Traditions
Religion
Biography

2.7 BOOK SHELF ICONS

BOOK SHELF ICON MOUNTING

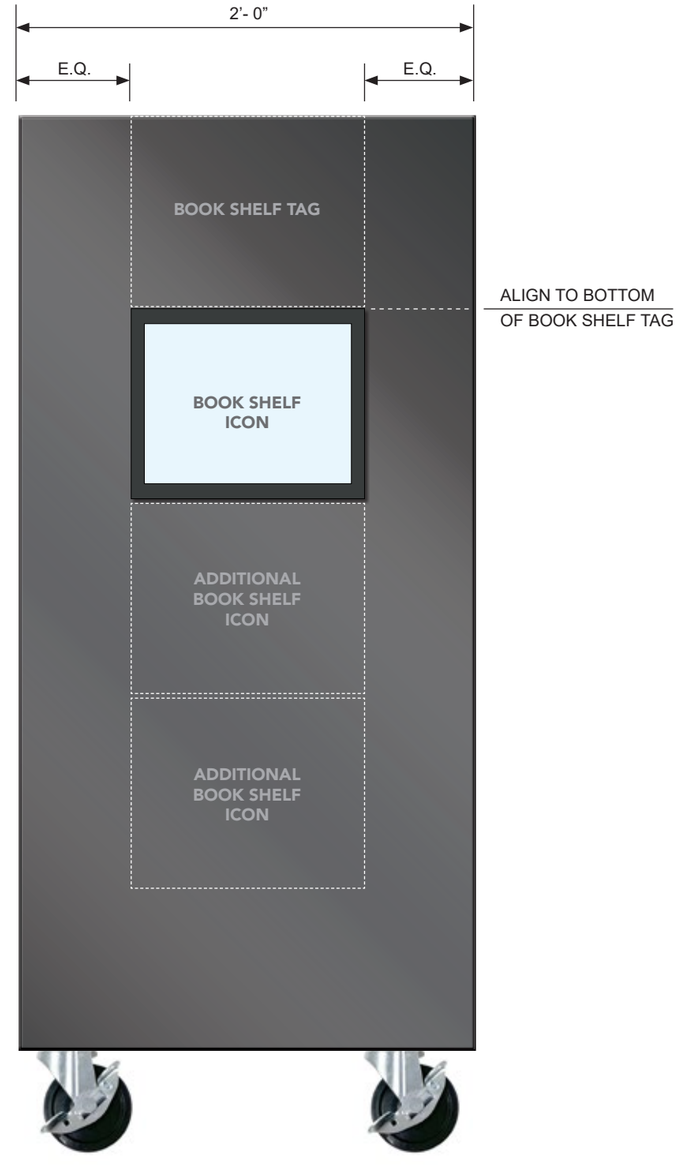


MAGNETIC SIGN HOLDER WITH ICON INSERT



TALL BOOK SHELF (TYPICAL)

SCALE: 1 1/2" =1'-0"



SHORT BOOK SHELF (TYPICAL)

SCALE: 1"=1'-0"

2.8 COMMUNITY WALL COLLATERAL DISPLAY
KIT OF PARTS

Each CPL library should provide 6’-0” to 8’-0” of designated community posting space. This wall serves as a central hub for campus and community information while reinforcing the design language of the library interiors.

1. **Wall Construction:** The posting area should incorporate slat wall panels that complement the surrounding interior material palette.

2. **Recessed Design:** Where possible, the wall should be recessed 4”-6” inches to create depth, visual definition, and an integrated appearance within the architecture.

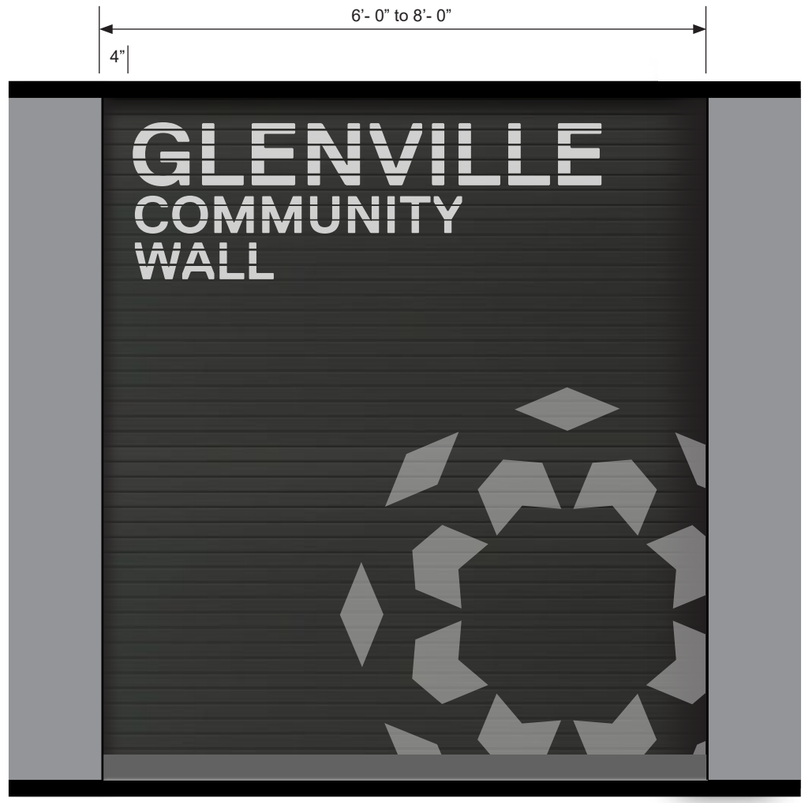
3. **Placement:** Community posting walls must be located in areas with ample viewing distance, ensuring that materials are visible, approachable, and accessible without obstructing circulation paths.

4. **Identification Text:** Each community wall must display the campus name along with the wording “Community Wall.” The identification text may be stained, painted, or applied in vinyl, depending on what best complements the interior environment and chosen wood tones.

The goal of the community wall is to provide a functional, accessible, and visually cohesive space that encourages community connection while seamlessly integrating with each library’s design.



SLAT WALL (LIGHT CONTRAST)
SCALE: 1/2” =1’-0”



SLAT WALL (DARK CONTRAST)
SCALE: 1/2” =1’-0”

2.8 COMMUNITY WALL COLLATERAL DISPLAY

MATERIALITY & ACCESSORIES

Because this display will be integral to both new and existing buildings, its materiality must remain flexible so the design team can align it with the surrounding interior architectural finishes. Allowing for a variety of material options within the installation will ensure it has the character to fit seamlessly into the context of the building, community, or space.

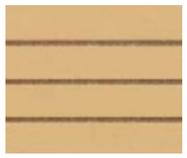
We recommend utilizing Marlite—or a comparable substitute—for the slat wall system, given their extensive selection of finishes and accessories, which provide both versatility and durability for this application.

Each wall panel should be fabricated from Digitally Printed Low Pressure Melamine (LPM), allowing all MDF-based walls to incorporate high-pressure laminate (HPL) colors and materials from any major manufacturer.

Wall designs should also integrate vinyl trim strips or vinyl color snaps in a tone that best conceals the recessed grooves of the wall. The goal is to reduce the visibility of panel lines and achieve a more continuous appearance across the surface. Where desired, custom inserts may be fabricated to further minimize the appearance of grooves and create a seamless installation.

For wall accessories, clear components from Displays2Go should be specified. This will ensure consistency of product across all campuses, provide cost-effective solutions, and allow for reliable sourcing and replacement over time.

MATERIALS

	COOL	WARM	RUSTIC
	 2046-SKY Nebbia	 310-SKY Sierra Maple	 2720-SKY Patina White
	 2045-SKY Natural Swiss Oak	 342-SKY Champagne Maple	 2048-SKY Volcanna
	 2047-SKY Sabbia	 317-SKY Alum Rock Maple	 2049-SKY Woodward Oak
WOODS	 2041-SKY Ashen Oak	 319-SKY Whittier Anigre	 2710-SKY Aged Barnside
WOODS	 2042-SKY Smoky Birch	 318-SKY Windsor Anigre	 2719-SKY Pallet Wood
BRICK	 2654-SKY Alabaster	 2653-SKY Independence Dark	 2661-SKY Pub Brick Light

ACCESSORIES



Acrylic Literature Pocket for Slatwall, 8.5 x 11 Magazines - Clear



Acrylic Literature Pocket for Slatwall, Fits 5.5-inch Magazines - Clear



Acrylic Brochure Pocket for Slatwall, Fits 4 x 9 Pamphlets - Clear



Acrylic Literature Pocket for Slatwall, 8.5 x 11 Magazines - Clear



6-Pocket Acrylic Business Card Holder for Slatwall - Clear

2.9 CPL COLLATERAL DISPLAY

MATERIALITY & ACCESSORIES

3.0

EXT. SIGNAGE & WAYFINDING

3.0 Signage Use
3.1 Arrows & Typography
3.2 Exterior Ground Signage
3.3 Exterior Building ID
3.4 Secondary Exterior Building ID
3.5 Entrance Door Signage
3.6 Building Address Numbers
3.7 Exterior Signage Specifications

3.0 SIGNAGE USE

The Cleveland Public Library (CPL) Interior & Exterior Signage Standards serve as a comprehensive guide for architects, designers, and CPL employees to ensure a cohesive and effective signage system across all CPL locations. These standards provide guidelines for maintaining brand consistency, improving navigation, and ensuring compliance with accessibility and local regulations. They must be referenced at every stage of signage planning, design, fabrication, and installation.

1. When to Use These Standards

These standards should be followed whenever exterior signage is being designed, installed, modified, or replaced at any CPL location. They apply to:

I. New construction and renovations
II. Updates to existing signage
III. Temporary signage needs
IV. Wayfinding improvements
V. Compliance reviews for local regulations and accessibility

2. Visual Identity & Brand Consistency

All exterior signage must align with CPL's brand identity to maintain consistency across branches, campuses, and facilities. When designing or specifying signage:

I. Use approved fonts, colors, and logo applications.
II. Follow size and placement guidelines to ensure visibility and uniformity.
III. Reference provided design templates and material specifications.

3. Navigation & Wayfinding

Signage must be designed and positioned to help visitors easily identify, enter, and navigate CPL facilities. When planning wayfinding signage:

I. Assess high-traffic areas and key decision points.
II. Use clear, concise messaging that aligns with CPL's wayfinding hierarchy.
III. Ensure consistency in directional signage across multiple locations.

4. Reducing Confusion in Complex Campuses

In multi-building or large-scale CPL locations, the exterior signage system should minimize confusion by:

I. Clearly designating entry points, pathways, and key destinations.
II. Incorporating maps or directory signage where necessary.
III. Using standardized symbols and terminology for clarity.

5. Compliance with Local Regulations

All signage installations must comply with local zoning laws, building codes, and other municipal or state regulations. When planning signage:

I. Verify that placement, size, and illumination comply with applicable codes.
II. Consult CPL's project or brand manager if there are any compliance concerns.
III. Obtain required permits before fabrication and installation.

6. Accessibility Standards

All exterior signage must meet accessibility requirements to ensure inclusivity for all visitors. When designing signage:

I. Use high-contrast text and backgrounds for readability.
II. Incorporate tactile and Braille elements where required.
III. Position signs at appropriate heights and angles for visibility.

7. Materials & Maintenance Guidelines

The signage system is designed for long-term durability and ease of maintenance. When specifying materials:

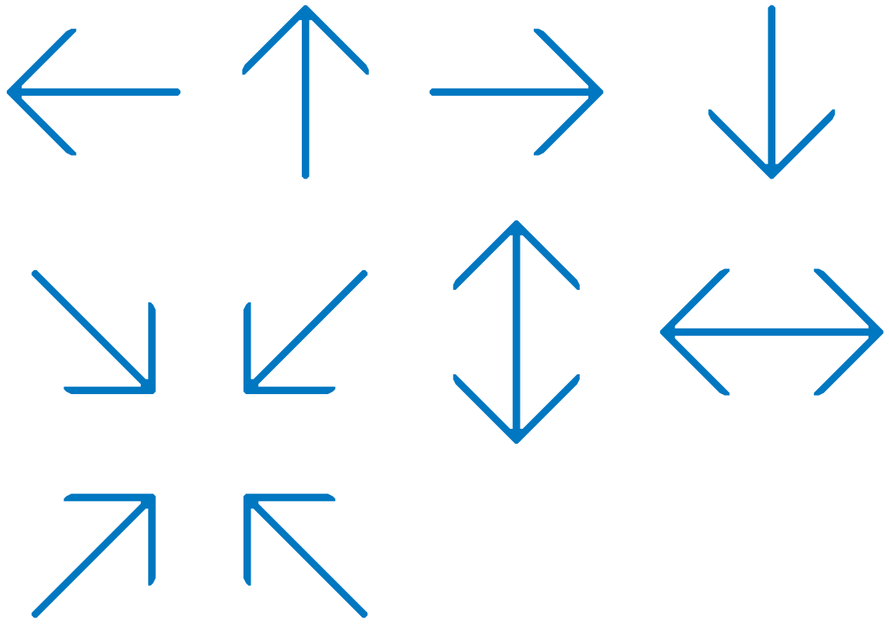
I. Use approved materials to ensure consistency and longevity.
II. Design for weather resistance and minimal upkeep.

Note to Designers or Specifiers:

If a project need or requires additional design components, submit any new design s or material modifications for CPL brand manager approval before implementation.

By adhering to these standards, architects, designers, and CPL employees will contribute to a seamless and user-friendly library experience. If there are any uncertainties or deviations required, consult CPL's project or brand manager for guidance.

EXTERIOR DIRECTIONAL ARROWS



WORK SANS LITE

ABCDEFGHIJKLMN
OPQRSTUVWXYZ
1234567890

REPLICA PRO REGULAR

ABCDEFGHIJKLMN
OPQRSTUVWXYZ
1234567890

3.2 EXTERIOR GROUND SIGNAGE

INSPIRATION

Building on the new book-locker graphics, this concept unifies exterior signage across the Cleveland Public Library (CPL) system by aligning every site element with the established campus logo lockups. From gateways and monuments to building-mounted IDs, parking, and pedestrian/vehicular wayfinding, the same visual grammar—type hierarchy, icon geometry, spacing, and proportional rules—creates an immediate “I’m at CPL” recognition at every approach.

For visitors, that consistency translates into a calmer, quicker read: long-range cues help drivers locate the right entrance; mid-range markers confirm they’re on course; close-range identifiers and directional blades remove hesitation at decision points. Sightlines, approach speeds, and viewing angles inform scale and placement so signs work with each building’s context while the brand thread stays intact.

The result is a cohesive curb-to-door journey—clear, confident, and unmistakably CPL—no matter which branch or streetscape you encounter.



3.2 EXTERIOR GROUND SIGNAGE

EXTERIOR SITE SIGNAGE CONCEPT 3



PRIMARY CAMPUS ID

SECONDARY CAMPUS ID

LARGE CAMPUS DIRECTIONAL

MEDIUM CAMPUS DIRECTIONAL

SMALL CAMPUS DIRECTIONAL

PEDESTRIAN TRAILBLAZER

COLUMN POST

POST & PANEL SIGN

CHANGEABLE TEMPORARY SIGN

3.2 EXTERIOR GROUND SIGNAGE

EXTERIOR SITE SIGNAGE CONCEPT 3



3.2 EXTERIOR GROUND SIGNAGE

EXTERIOR SITE SIGNAGE CONCEPT 3

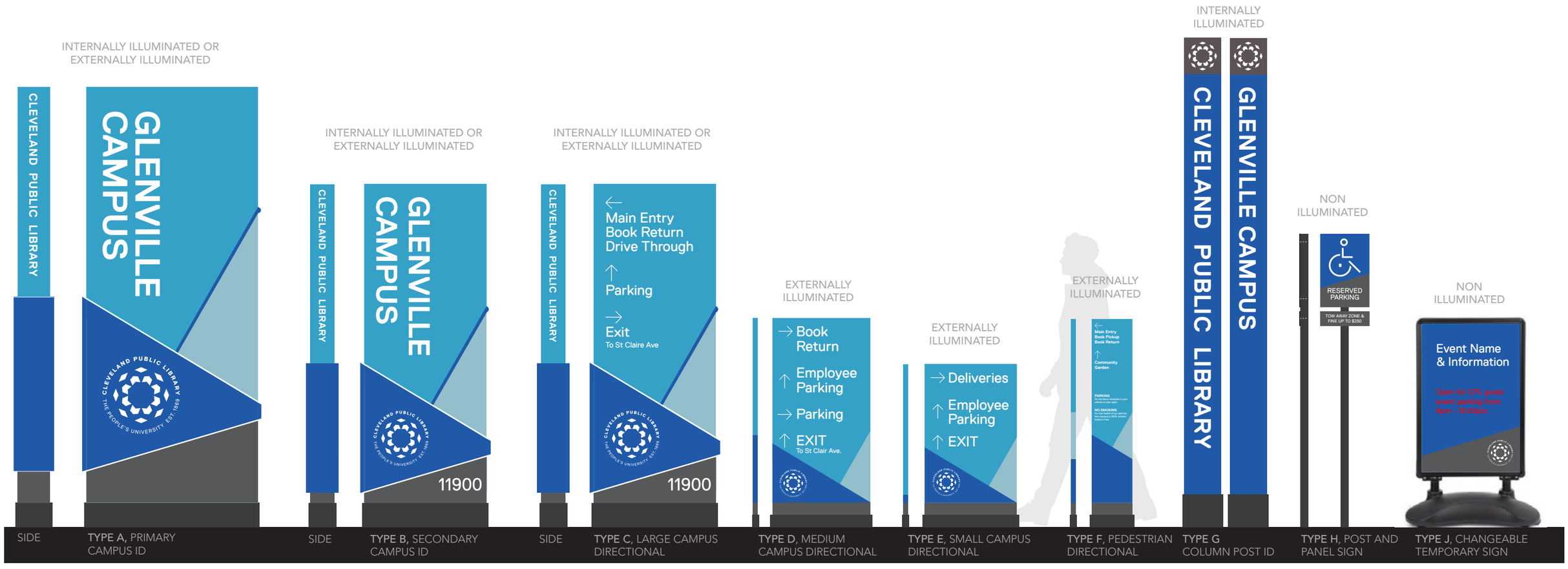
Similar to how the book lockers blue lighting glows from its seams the signage would have the same appearance at night, drawing your eye to the CPL primary illuminated logo at pedestrian height.





3.2 EXTERIOR GROUND SIGNAGE

EXTERIOR SITE SIGNAGE FAMILY

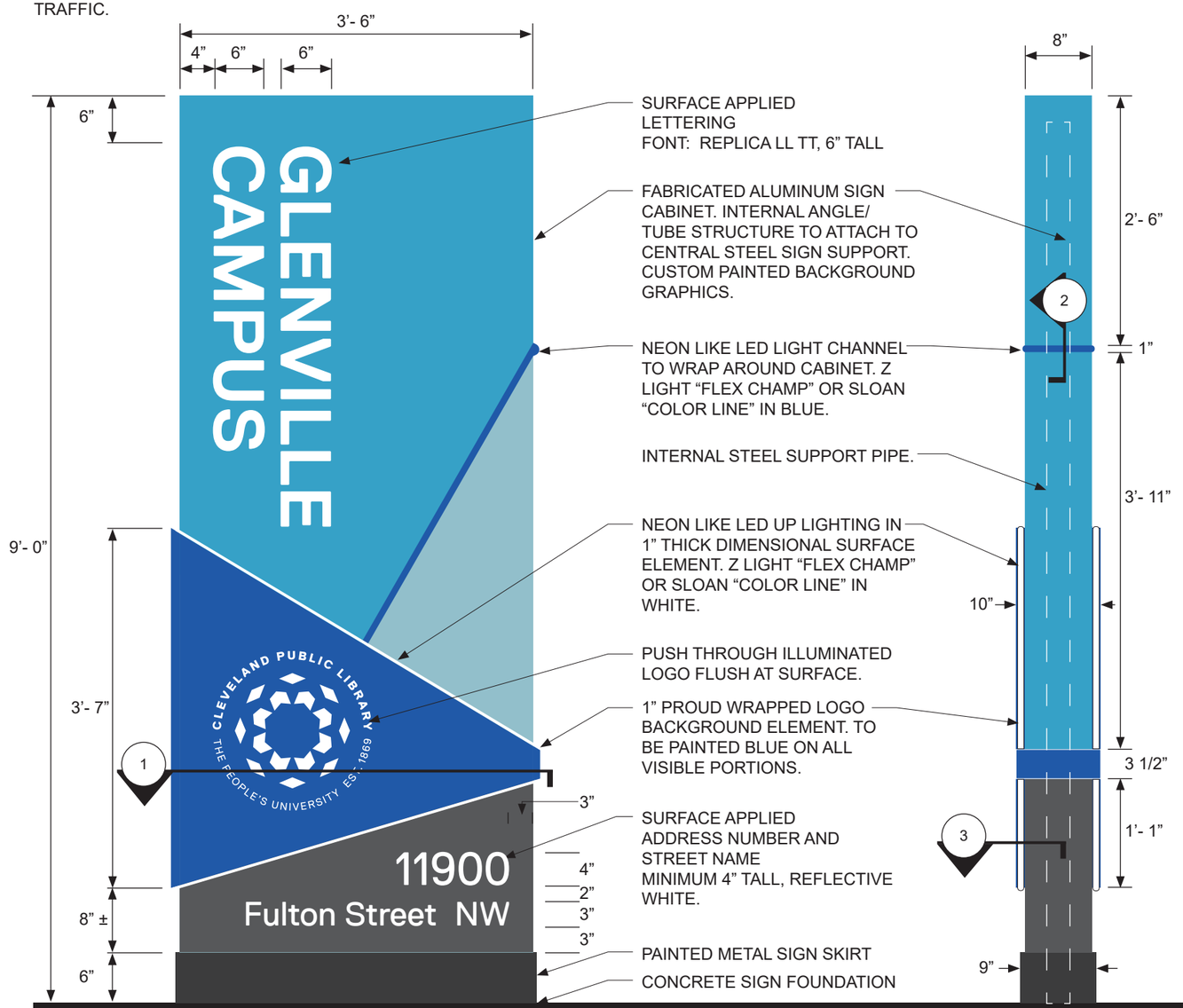


3.2 EXTERIOR GROUND SIGNAGE

TYPE A, PRIMARY SITE ID -INTERNALLY ILLUMINATED

USE:
THIS SIGN IS INTENDED FOR MAXIMUM IDENTIFICATION OF EACH FACILITY. CREATING A LANDMARK IDENTIFYING CPL FOR VEHICULAR AND PEDESTRIAN TRAFFIC.

PLACEMENT:
IT IS TO BE LOCATED ALONG THE ROADWAY AT THE FRONT OF THE BUILDING ASSUMING PRIMARY DEMARCATION.

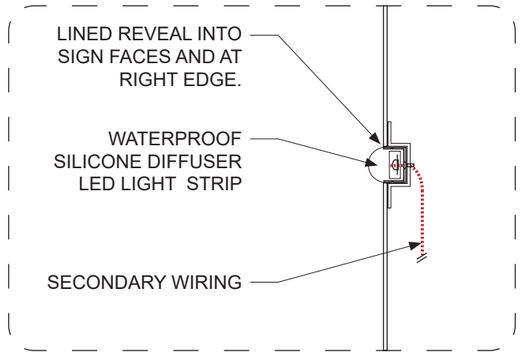


SIGN MESSAGING:

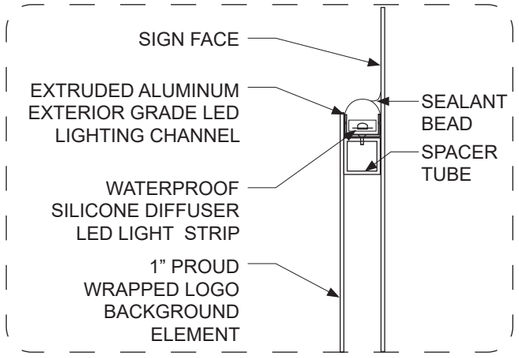
-ALL FINAL COPY AND SIGN CONTENT TO BE PROVIDED BY CPL.
-TYPESETTING OF ALL FACES OF ALL SIGNS TO BE BY THE SIGNAGE CONTRACTOR.
-ALL SIGN LAYOUTS BY THE SIGNAGE CONTRACTOR TO BE APPROVED BY CPL. PRIOR TO FABRICATION AND INSTALLATION.

SIGN FOUNDATIONS: FOUNDATIONS TO BE POURED IN PLACE CONCRETE. ANY EXPOSED PORTIONS TO HAVE A SMOOTH, FLAT TROWELED FINISH WITH NEAT CORNERS OR RADII.

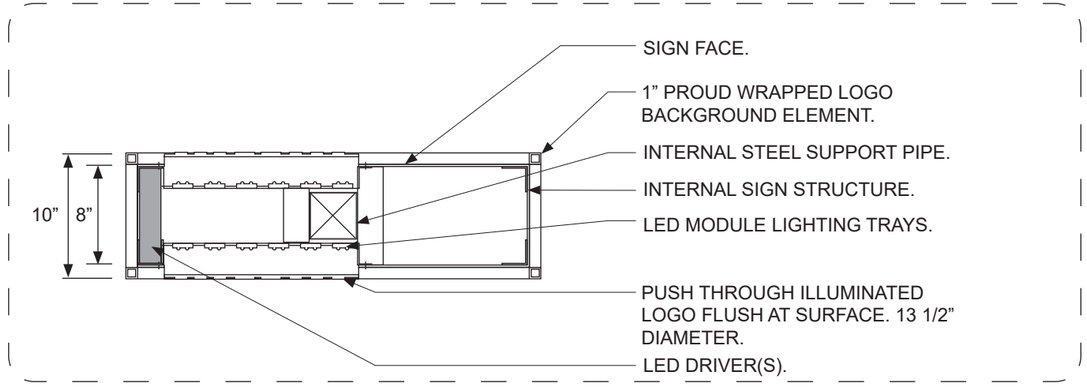
SIGN CONSTRUCTION: ALL OUTDOOR SIGNS AND DISPLAY STRUCTURES SHALL BE DESIGNED AND CONSTRUCTED TO WITHSTAND THE WIND PRESSURES SPECIFIED IN THE CLEVELAND OHIO BUILDING CODE AND OBBC. REFERENCE CHAPTER 3133 OUTDOOR SIGNS AND DISPLAYS FOR ADDITIONAL INFORMATION.



2 REVEAL LIGHTING, TYPICAL SECTION
Scale: 3" = 1'- 0"



3 EDGE LIGHTING, TYPICAL SECTION
Scale: 3" = 1'- 0"



1 ILLUMINATED LOGO, TYPICAL SECTION
Scale: 1" = 1'- 0"

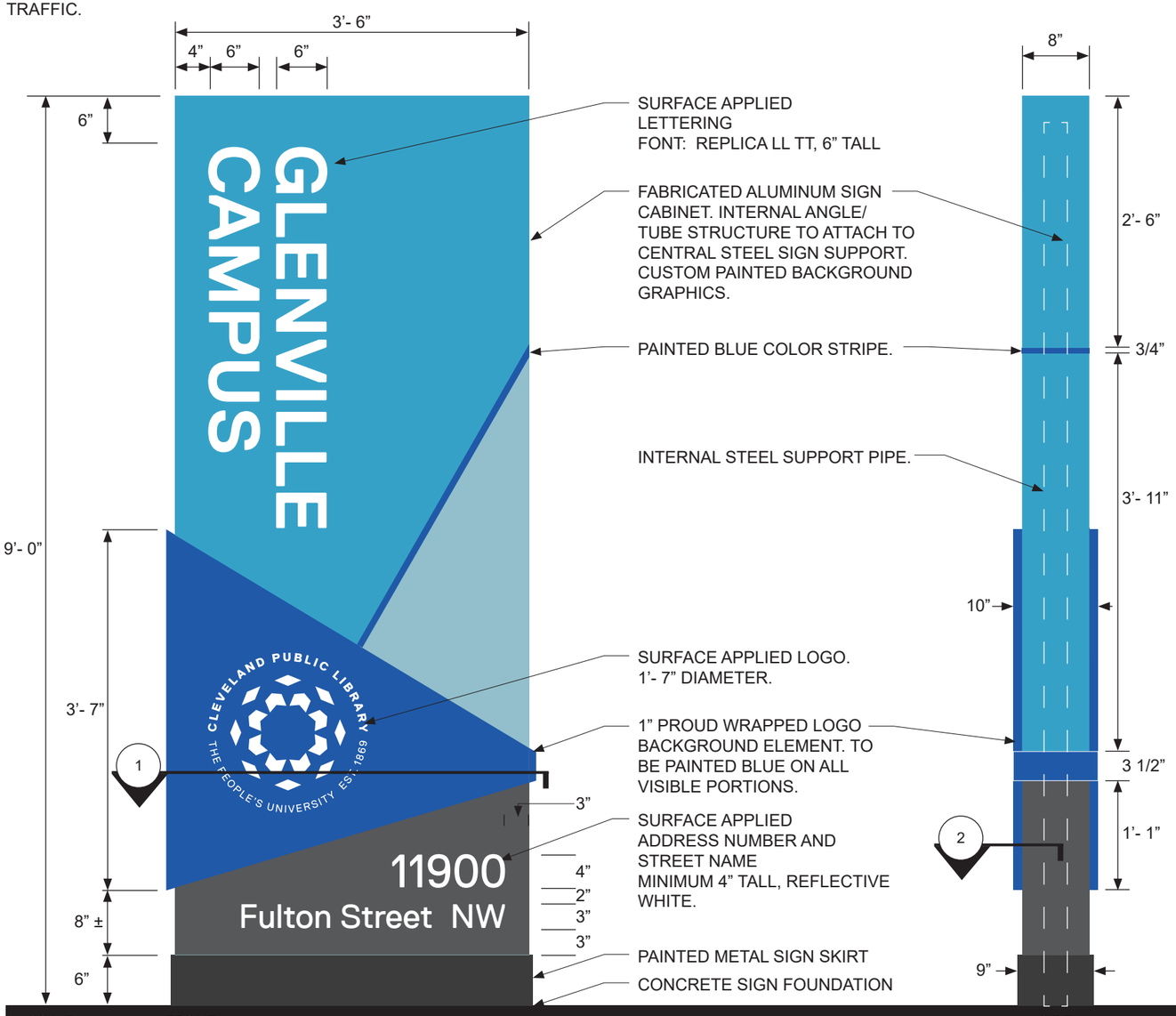
3.2 EXTERIOR GROUND SIGNAGE

TYPE A.1, PRIMARY SITE ID -NON ILLUMINATED

USE:
THIS SIGN IS INTENDED FOR MAXIMUM IDENTIFICATION OF EACH FACILITY. CREATING A LANDMARK IDENTIFYING CPL FOR VEHICULAR AND PEDESTRIAN TRAFFIC.

PLACEMENT:
IT IS TO BE LOCATED ALONG THE ROADWAY AT THE FRONT OF THE BUILDING ASSUMING PRIMARY DEMARCATION.

NOTE: UPLIGHTING WITH GROUND LIGHTS IS RECOMMENDED FOR EXTERNAL ILLUMINATION.



SCALE:
3/4" = 1'- 0"

FRONT
TYPE A -PRIMARY CAMPUS ID

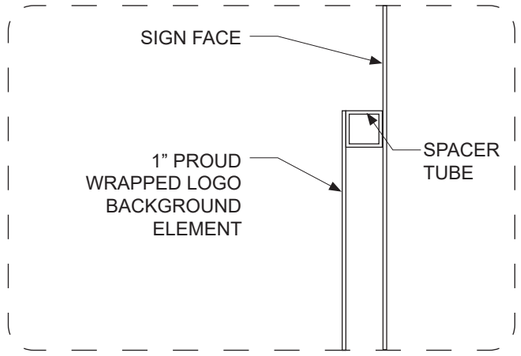
SIDE

SIGN MESSAGING:

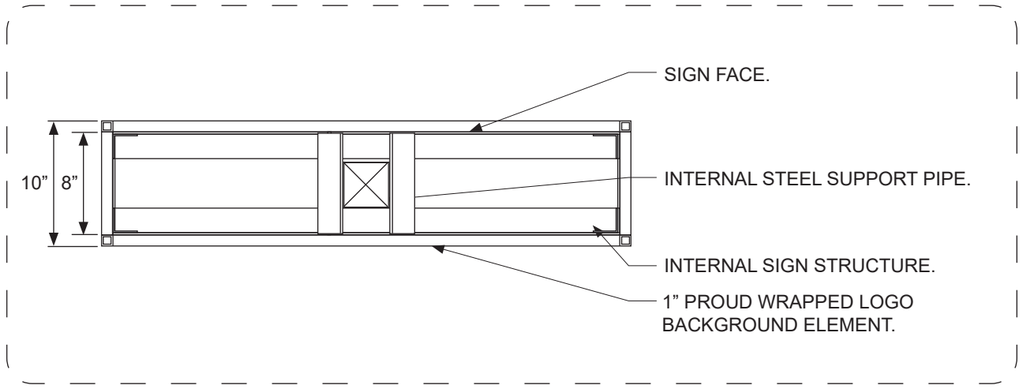
-ALL FINAL COPY AND SIGN CONTENT TO BE PROVIDED BY CPL.
-TYPESETTING OF ALL FACES OF ALL SIGNS TO BE BY THE SIGNAGE CONTRACTOR.
-ALL SIGN LAYOUTS BY THE SIGNAGE CONTRACTOR TO BE APPROVED BY CPL. PRIOR TO FABRICATION AND INSTALLATION.

SIGN FOUNDATIONS: FOUNDATIONS TO BE POURED IN PLACE CONCRETE. ANY EXPOSED PORTIONS TO HAVE A SMOOTH, FLAT TROWELED FINISH WITH NEAT CORNERS OR RADII.

SIGN CONSTRUCTION: ALL OUTDOOR SIGNS AND DISPLAY STRUCTURES SHALL BE DESIGNED AND CONSTRUCTED TO WITHSTAND THE WIND PRESSURES SPECIFIED IN THE CLEVELAND OHIO BUILDING CODE AND OBBC. REFERENCE CHAPTER 3133 OUTDOOR SIGNS AND DISPLAYS FOR ADDITIONAL INFORMATION.



2 EDGE LIGHTING, TYPICAL SECTION
Scale: 3" = 1'- 0"



1 NON ILLUMINATED SIGN CABINET, TYPICAL SECTION
Scale: 1" = 1'- 0"

3.2 EXTERIOR GROUND SIGNAGE

TYPE B, SECONDARY CAMPUS ID -INTERNALLY ILLUMINATED

USE:
THIS SIGN IS INTENDED TO BE USED TO IDENTIFY THE FACILITY. IT'S SIZE PROVIDES PRESENCE AND VISIBILITY IDENTIFYING CPL.

PLACEMENT:
TO BE USED AT LOCATIONS WHERE THE LARGER CAMPUS ID MIGHT BE TO BIG. IT IS TO BE LOCATED ALONG THE ROADWAY AT THE FRONT OF THE BUILDING.

SIGN MESSAGING:

-ALL FINAL COPY AND SIGN CONTENT TO BE PROVIDED BY CPL.

-TYPESETTING OF ALL FACES OF ALL SIGNS TO BE BY THE SIGNAGE CONTRACTOR.

-ALL SIGN LAYOUTS BY THE SIGNAGE CONTRACTOR TO BE APPROVED BY CPL. PRIOR TO FABRICATION AND INSTALLATION.

SIGN FOUNDATIONS: FOUNDATIONS TO BE POURED IN PLACE CONCRETE. ANY EXPOSED PORTIONS TO HAVE A SMOOTH, FLAT TROWELED FINISH WITH NEAT CORNERS OR RADII.

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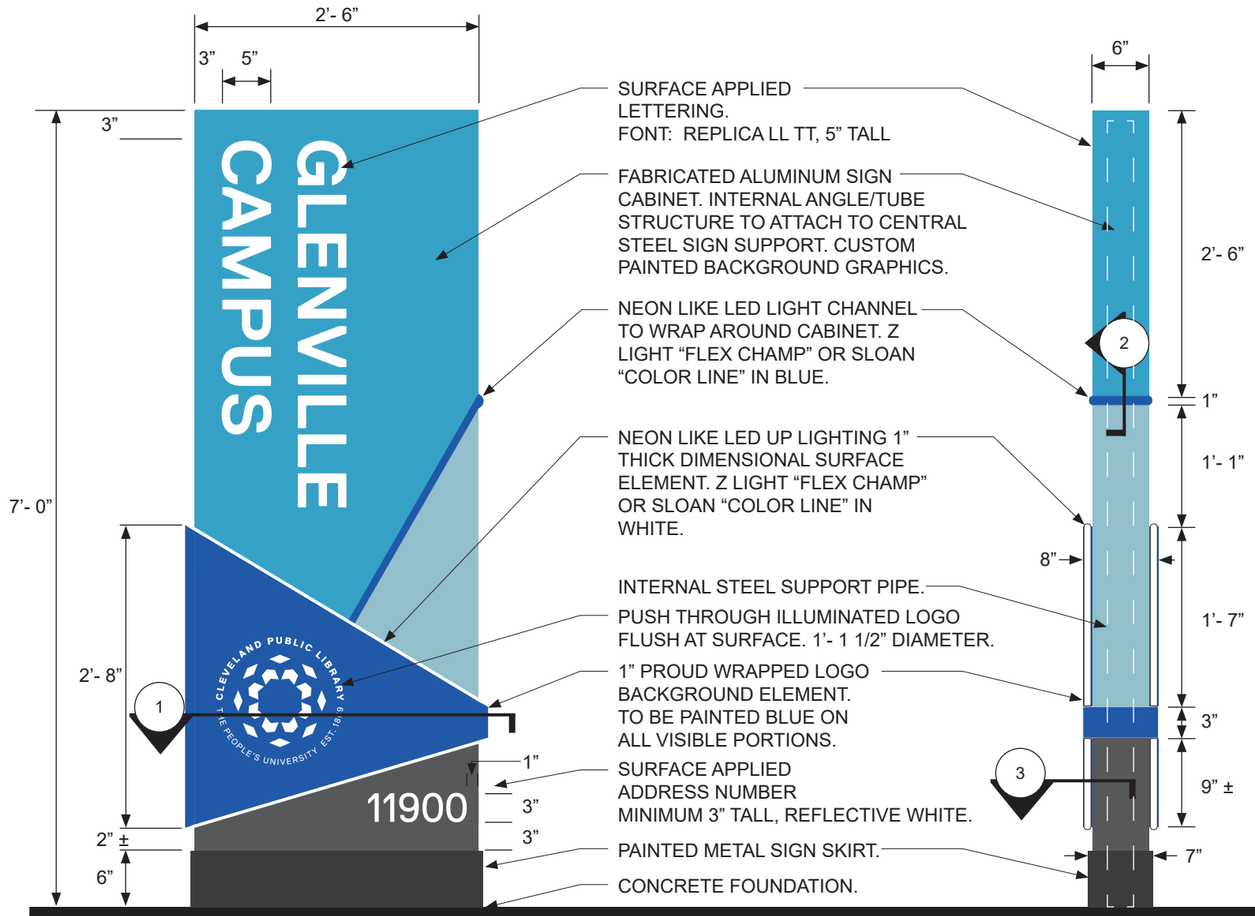
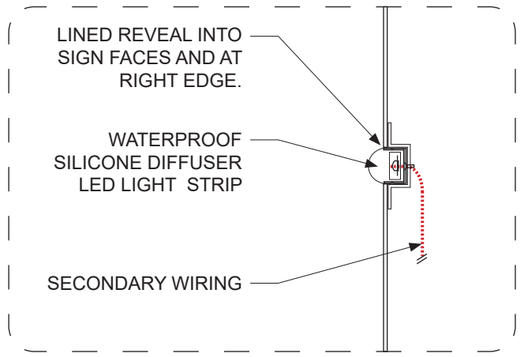
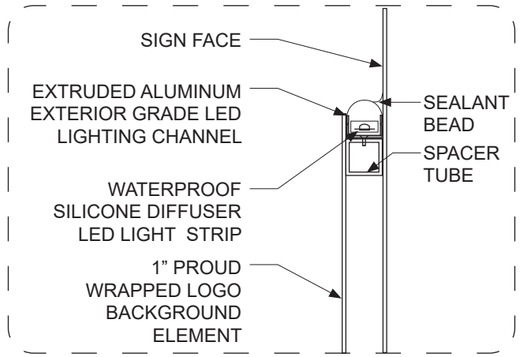
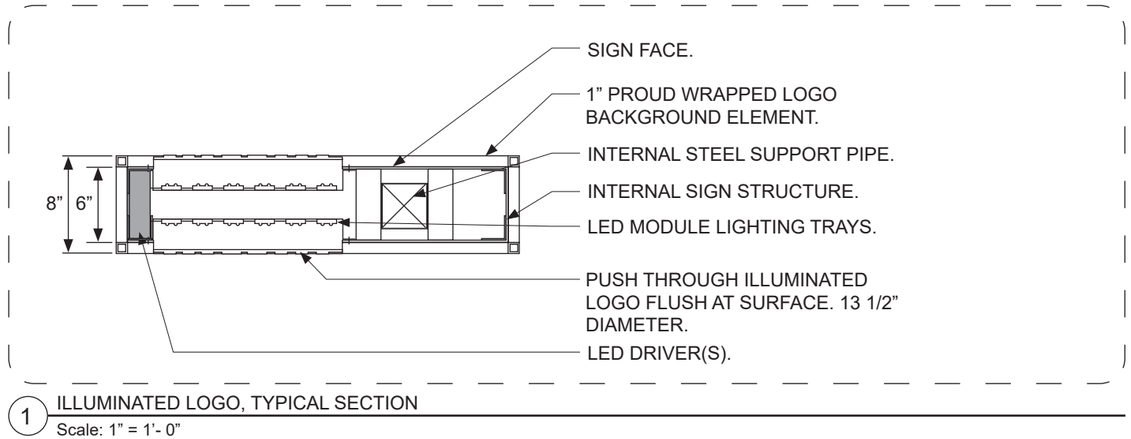




2 REVEAL LIGHTING, TYPICAL SECTION
Scale: 3" = 1'- 0"



3 EDGE LIGHTING, TYPICAL SECTION
Scale: 3" = 1'- 0"



1 ILLUMINATED LOGO, TYPICAL SECTION
Scale: 1" = 1'- 0"

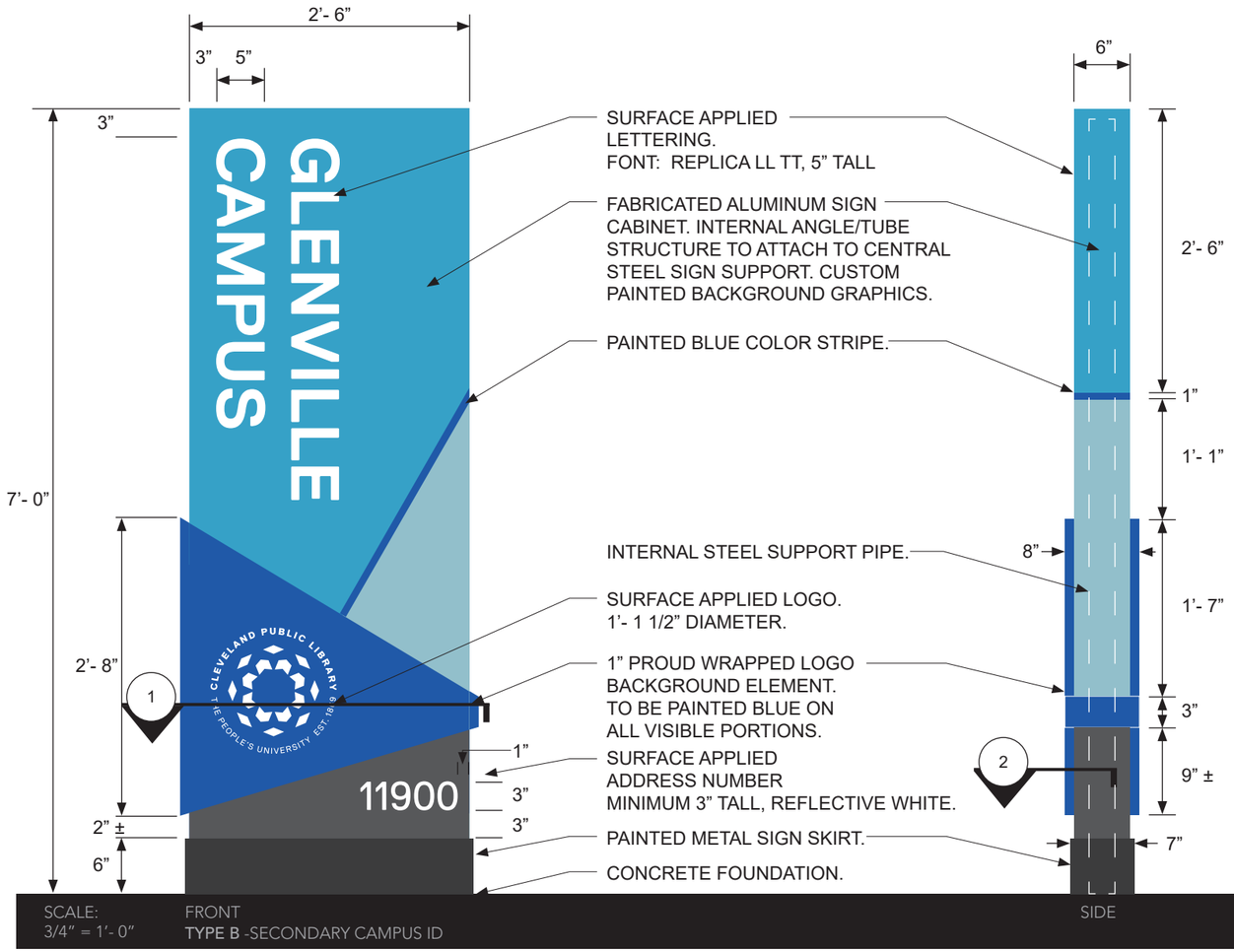
3.2 EXTERIOR GROUND SIGNAGE

TYPE B.1, SECONDARY CAMPUS ID -NON ILLUMINATED

USE:
THIS SIGN IS INTENDED TO BE USED TO IDENTIFY THE FACILITY. IT'S SIZE PROVIDES PRESENCE AND VISIBILITY IDENTIFYING CPL.

PLACEMENT:
TO BE USED AT LOCATIONS WHERE THE LARGER CAMPUS ID MIGHT BE TO BIG. IT IS TO BE LOCATED ALONG THE ROADWAY AT THE FRONT OF THE BUILDING.

NOTE: UPLIGHTING WITH GROUND LIGHTS IS RECOMMENDED FOR EXTERNAL ILLUMINATION.



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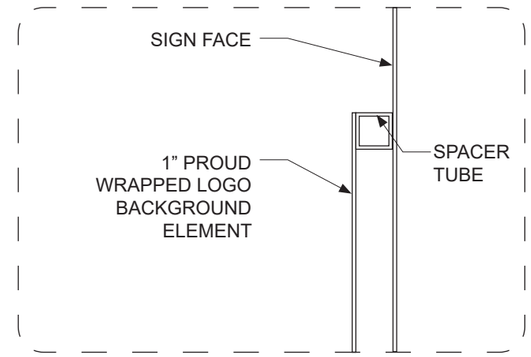
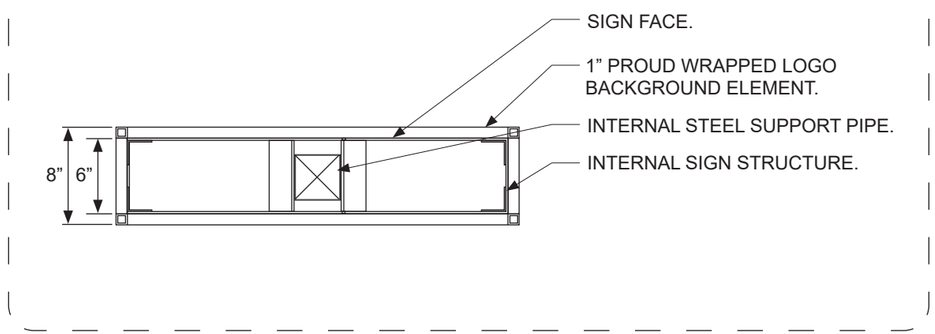


2 EDGE LIGHTING, TYPICAL SECTION
Scale: 3" = 1'- 0"



1 NON ILLUMINATED SIGN CABINET, TYPICAL SECTION
Scale: 1" = 1'- 0"

3.2 EXTERIOR GROUND SIGNAGE

TYPE C, LARGE CAMPUS DIRECTIONAL -INTERNALLY ILLUMINATED

USE:
THIS SIGN IS INTENDED TO BE USED FOR VEHICULAR AND PEDESTRIAN DIRECTIONAL INFORMATION AT KEY DECISION POINTS.

PLACEMENT:
TO BE LOCATED TO DIRECT TO MAIN ENTRANCES AND PARKING AREAS. IT'S LARGE SIZE PROVIDES PRESENCE AND VISIBILITY.

SIGN MESSAGING:

-ALL FINAL COPY AND SIGN CONTENT TO BE PROVIDED BY CPL.

-TYPESETTING OF ALL FACES OF ALL SIGNS TO BE BY THE SIGNAGE CONTRACTOR.

-ALL SIGN LAYOUTS BY THE SIGNAGE CONTRACTOR TO BE APPROVED BY CPL. PRIOR TO FABRICATION AND INSTALLATION.

SIGN FOUNDATIONS: FOUNDATIONS TO BE POURED IN PLACE CONCRETE. ANY EXPOSED PORTIONS TO HAVE A SMOOTH, FLAT TROWELED FINISH WITH NEAT CORNERS OR RADII.

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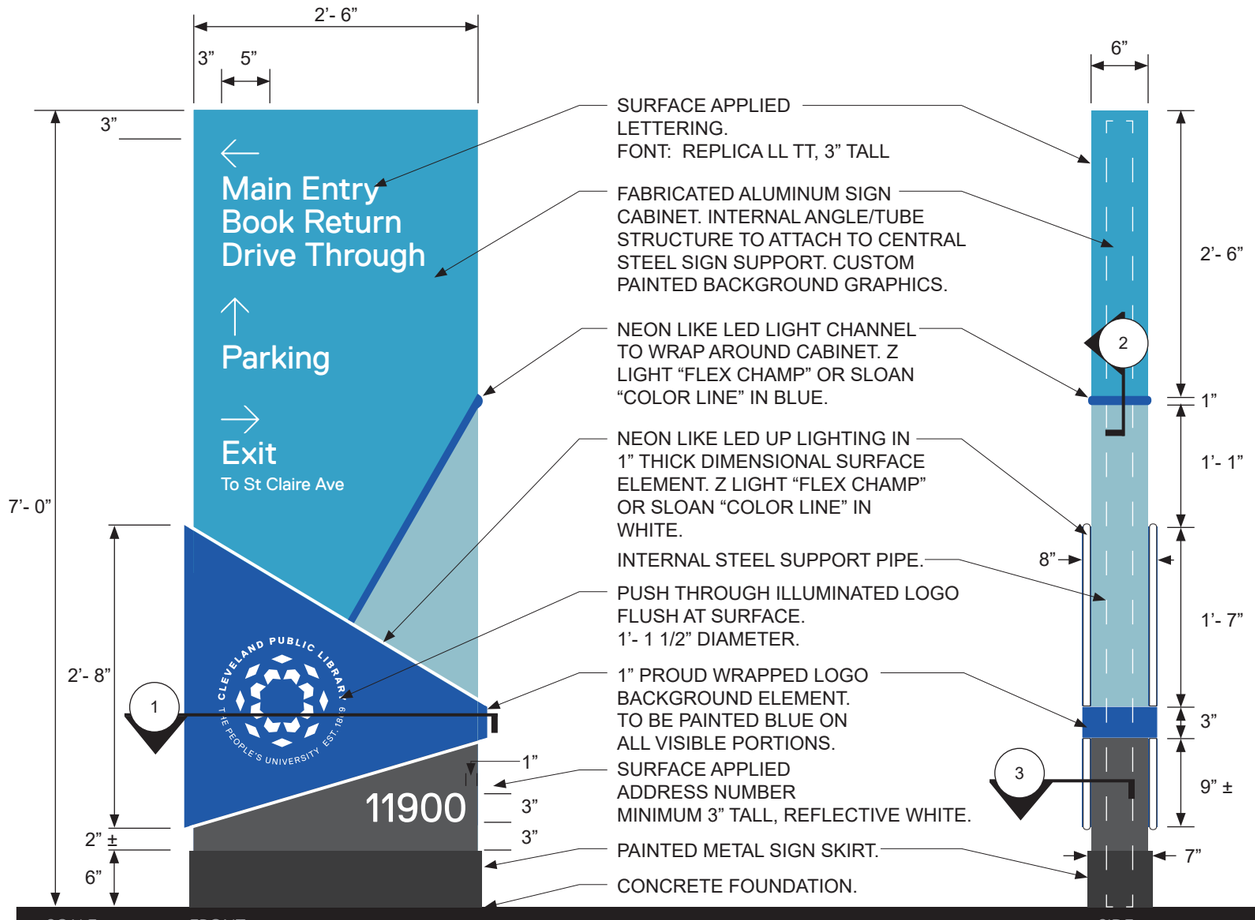
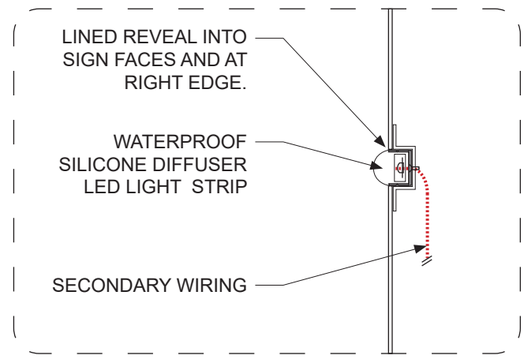
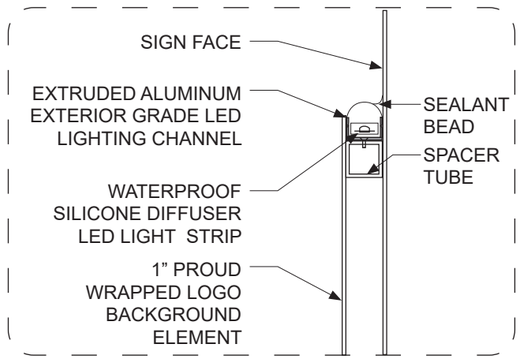
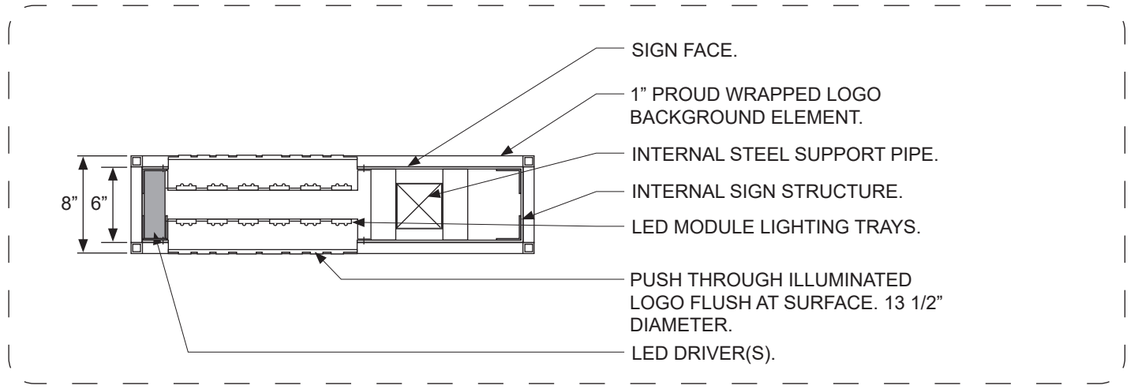




2 REVEAL LIGHTING, TYPICAL SECTION
Scale: 3" = 1'- 0"



3 EDGE LIGHTING, TYPICAL SECTION
Scale: 3" = 1'- 0"



1 ILLUMINATED LOGO, TYPICAL SECTION
Scale: 1" = 1'- 0"

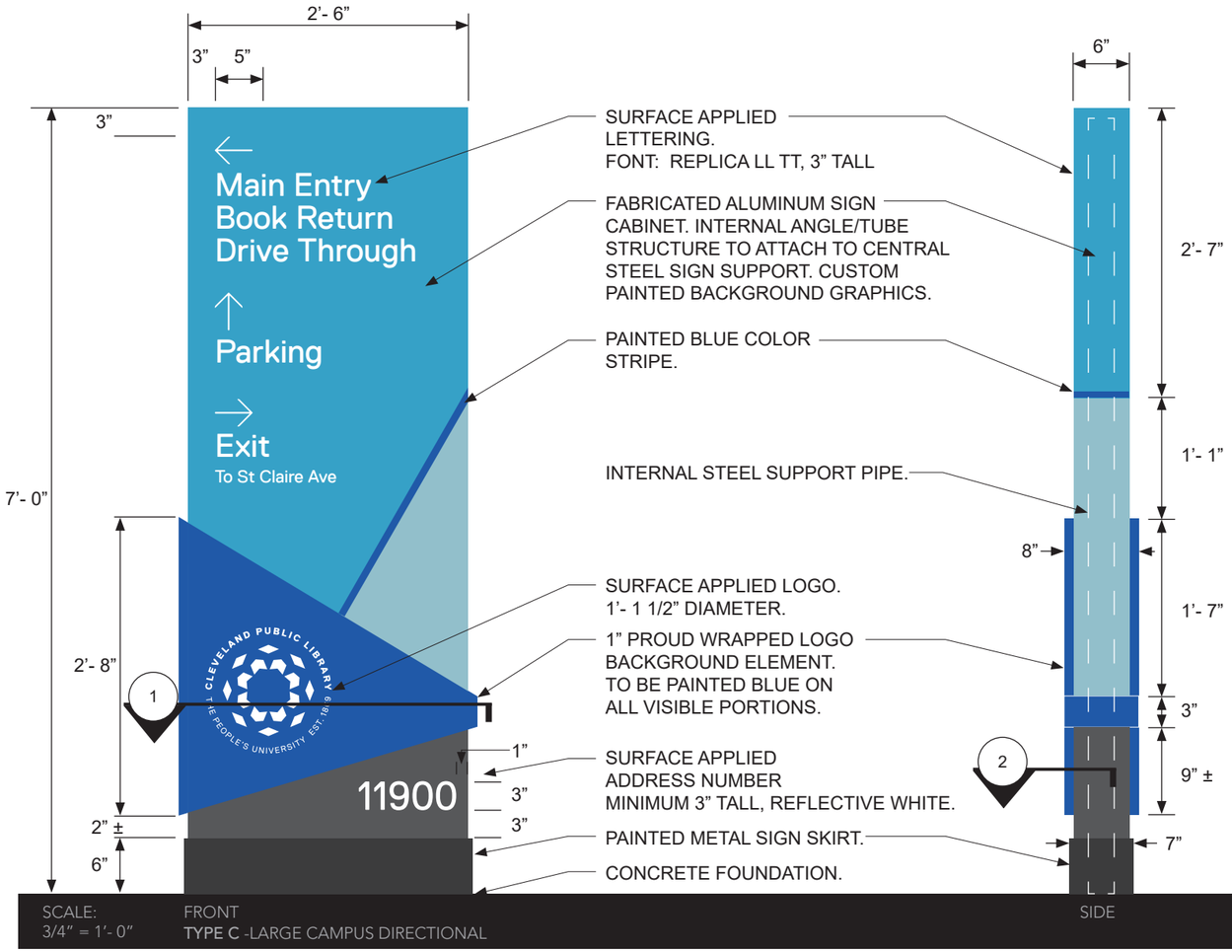
3.2 EXTERIOR GROUND SIGNAGE

TYPE C.1, LARGE CAMPUS DIRECTIONAL -NON ILLUMINATED

USE:
THIS SIGN IS INTENDED TO BE USED FOR VEHICULAR AND PEDESTRIAN DIRECTIONAL INFORMATION AT KEY DECISION POINTS.

PLACEMENT:
TO BE LOCATED TO DIRECT TO MAIN ENTRANCES AND PARKING AREAS. IT'S LARGE SIZE PROVIDES PRESENCE AND VISIBILITY.

NOTE: UPLIGHTING WITH GROUND LIGHTS IS RECOMMENDED FOR EXTERNAL ILLUMINATION.



SCALE:
3/4" = 1'- 0"

FRONT
TYPE C -LARGE CAMPUS DIRECTIONAL

SIDE

SIGN MESSAGING:

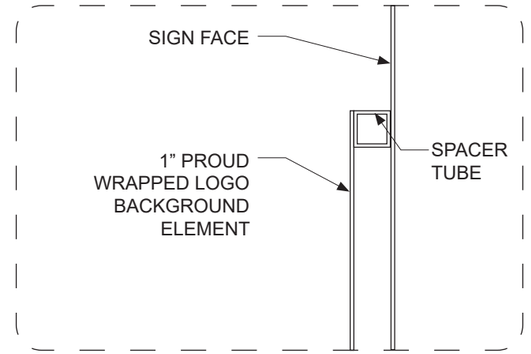
-ALL FINAL COPY AND SIGN CONTENT TO BE PROVIDED BY CPL.

-TYPESETTING OF ALL FACES OF ALL SIGNS TO BE BY THE SIGNAGE CONTRACTOR.

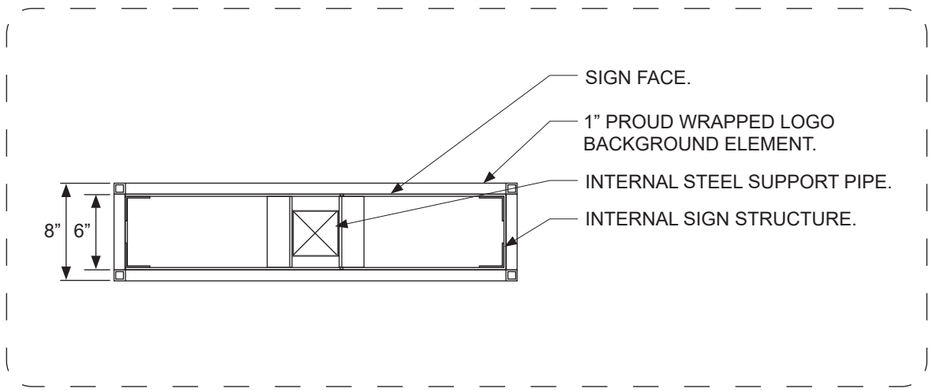
-ALL SIGN LAYOUTS BY THE SIGNAGE CONTRACTOR TO BE APPROVED BY CPL. PRIOR TO FABRICATION AND INSTALLATION.

SIGN FOUNDATIONS: FOUNDATIONS TO BE POURED IN PLACE CONCRETE. ANY EXPOSED PORTIONS TO HAVE A SMOOTH, FLAT TROWELED FINISH WITH NEAT CORNERS OR RADII.

SIGN CONSTRUCTION: ALL OUTDOOR SIGNS AND DISPLAY STRUCTURES SHALL BE DESIGNED AND CONSTRUCTED TO WITHSTAND THE WIND PRESSURES SPECIFIED IN THE CLEVELAND OHIO BUILDING CODE AND OBBC. REFERENCE CHAPTER 3133 OUTDOOR SIGNS AND DISPLAYS FOR ADDITIONAL INFORMATION.



2 EDGE LIGHTING, TYPICAL SECTION
Scale: 3" = 1'- 0"



1 NON ILLUMINATED SIGN CABINET, TYPICAL SECTION
Scale: 1" = 1'- 0"

3.2 EXTERIOR GROUND SIGNAGE

TYPE D, MEDIUM CAMPUS DIRECTIONAL

USE:
THIS SIGN IS INTENDED TO BE USED FOR VEHICULAR AND PEDESTRIAN DIRECTIONAL INFORMATION.

PLACEMENT:
IT'S MEDIUM SIZE IS USEFUL FOR SECONDARY DIRECTIONAL INFORMATION DISSEMINATION ALONG THE PATH OF TRAVEL.

SIGN MESSAGING:

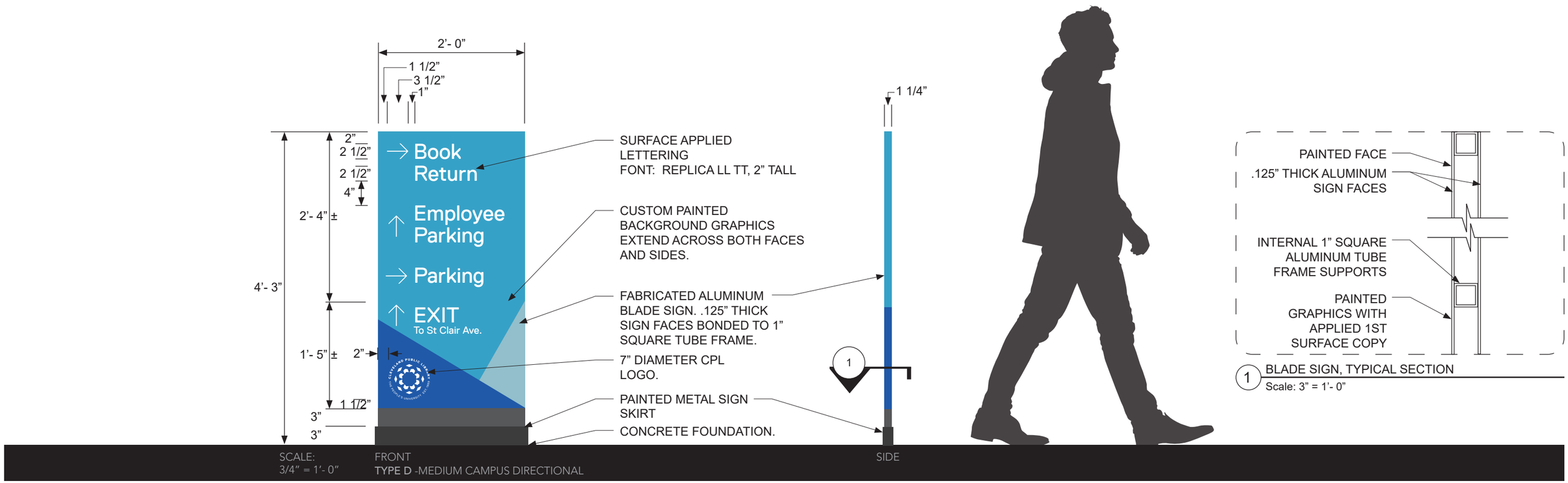
-ALL FINAL COPY AND SIGN CONTENT TO BE PROVIDED BY CPL.

-TYPESETTING OF ALL FACES OF ALL SIGNS TO BE BY THE SIGNAGE CONTRACTOR.

-ALL SIGN LAYOUTS BY THE SIGNAGE CONTRACTOR TO BE APPROVED BY CPL. PRIOR TO FABRICATION AND INSTALLATION.

SIGN FOUNDATIONS: FOUNDATIONS TO BE POURED IN PLACE CONCRETE. ANY EXPOSED PORTIONS TO HAVE A SMOOTH, FLAT TROWELED FINISH WITH NEAT CORNERS OR RADII.

SIGN CONSTRUCTION: ALL OUTDOOR SIGNS AND DISPLAY STRUCTURES SHALL BE DESIGNED AND CONSTRUCTED TO WITHSTAND THE WIND PRESSURES SPECIFIED IN THE CLEVELAND OHIO BUILDING CODE AND OBBC. REFERENCE CHAPTER 3133 OUTDOOR SIGNS AND DISPLAYS FOR ADDITIONAL INFORMATION.



3.2 EXTERIOR GROUND SIGNAGE

TYPE E, SMALL CAMPUS DIRECTIONAL

USE:
THIS SIGN IS INTENDED TO BE USED FOR VEHICULAR AND PEDESTRIAN DIRECTIONAL INFORMATION.

PLACEMENT:
IT'S SMALLER SIZE IS USEFUL FOR TERTIARY DIRECTIONAL INFORMATION DISSEMINATION ALONG THE PATH OF TRAVEL.

SIGN MESSAGING:

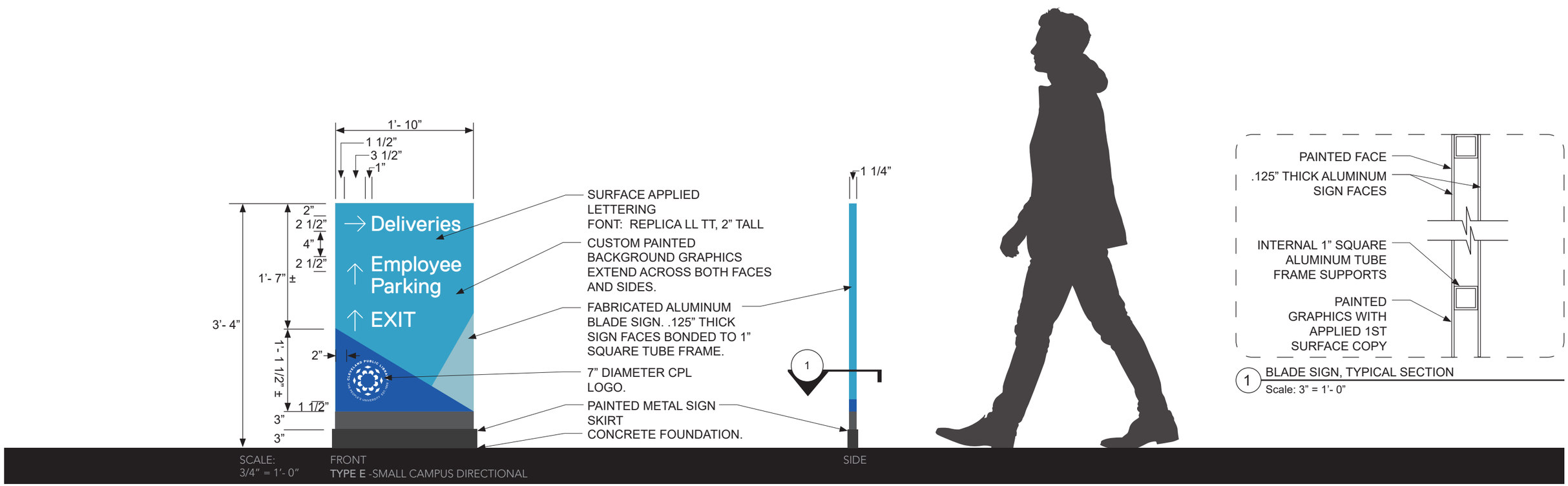
-ALL FINAL COPY AND SIGN CONTENT TO BE PROVIDED BY CPL.

-TYPESETTING OF ALL FACES OF ALL SIGNS TO BE BY THE SIGNAGE CONTRACTOR.

-ALL SIGN LAYOUTS BY THE SIGNAGE CONTRACTOR TO BE APPROVED BY CPL. PRIOR TO FABRICATION AND INSTALLATION.

SIGN FOUNDATIONS: FOUNDATIONS TO BE POURED IN PLACE CONCRETE. ANY EXPOSED PORTIONS TO HAVE A SMOOTH, FLAT TROWELED FINISH WITH NEAT CORNERS OR RADII.

SIGN CONSTRUCTION: ALL OUTDOOR SIGNS AND DISPLAY STRUCTURES SHALL BE DESIGNED AND CONSTRUCTED TO WITHSTAND THE WIND PRESSURES SPECIFIED IN THE CLEVELAND OHIO BUILDING CODE AND OBBC. REFERENCE CHAPTER 3133 OUTDOOR SIGNS AND DISPLAYS FOR ADDITIONAL INFORMATION.



3.2 EXTERIOR GROUND SIGNAGE

TYPE F, PEDESTRIAN DIRECTIONAL

USE:
THIS SIGN IS INTENDED TO BE USED FOR PEDESTRIAN DIRECTIONAL INFORMATION DISSEMINATION.

PLACEMENT:
IT'S SMALLER SIZE IS USEFUL FOR NON VEHICULAR DIRECTIONAL INFORMATION ALONG PEDESTRIAN ACCESS POINTS AND ADJACENT WALKWAYS.

SIGN MESSAGING:

-ALL FINAL COPY AND SIGN CONTENT TO BE PROVIDED BY CPL.

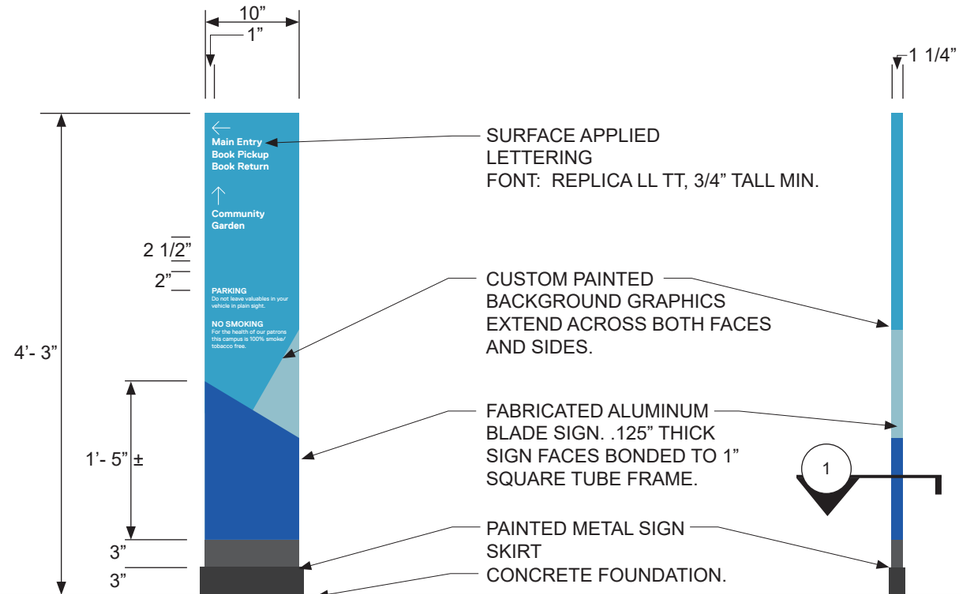
-TYPESETTING OF ALL FACES OF ALL SIGNS TO BE BY THE SIGNAGE CONTRACTOR.

-ALL SIGN LAYOUTS BY THE SIGNAGE CONTRACTOR TO BE APPROVED BY CPL. PRIOR TO FABRICATION AND INSTALLATION.

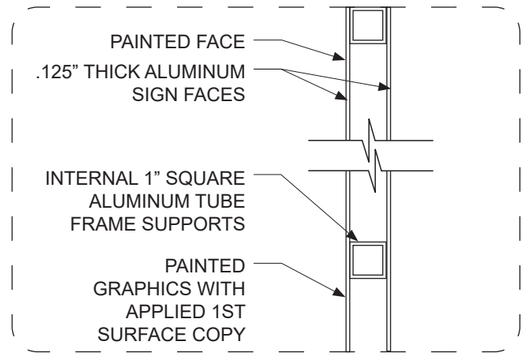
SIGN FOUNDATIONS: FOUNDATIONS TO BE POURED IN PLACE CONCRETE. ANY EXPOSED PORTIONS TO HAVE A SMOOTH, FLAT TROWELED FINISH WITH NEAT CORNERS OR RADII.

SIGN CONSTRUCTION: ALL OUTDOOR SIGNS AND DISPLAY STRUCTURES SHALL BE DESIGNED AND CONSTRUCTED TO WITHSTAND THE WIND PRESSURES SPECIFIED IN THE CLEVELAND OHIO BUILDING CODE AND OBBC. REFERENCE CHAPTER 3133 OUTDOOR SIGNS AND DISPLAYS FOR ADDITIONAL INFORMATION.





TYPE F -PEDESTRIAN DIRECTIONAL



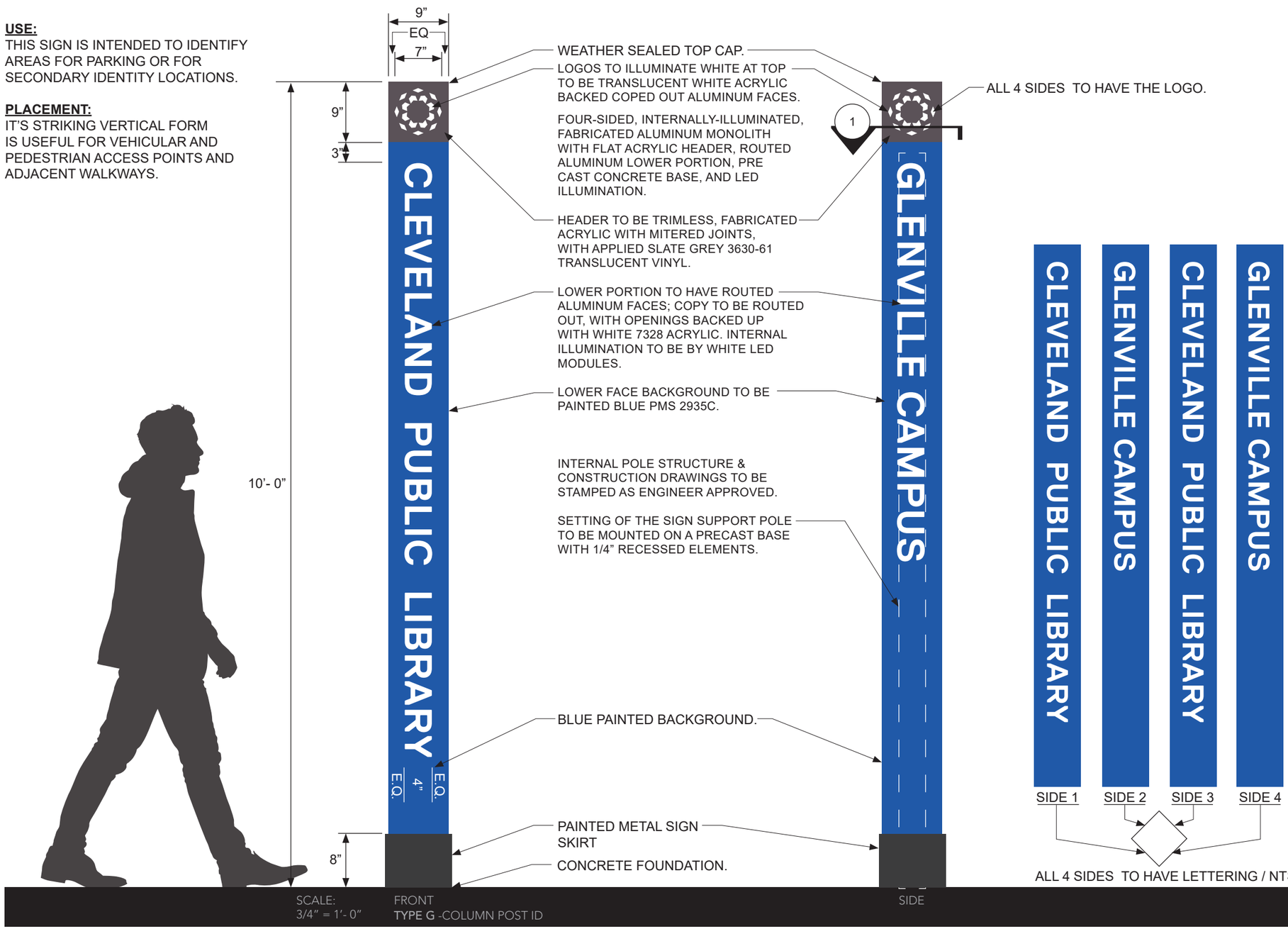
1 BLADE SIGN, TYPICAL SECTION
Scale: 3” = 1’- 0”

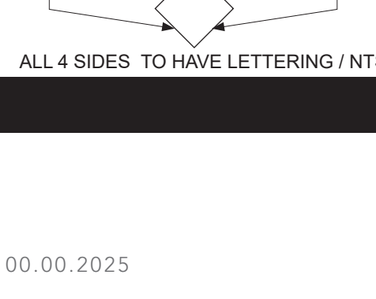
3.2 EXTERIOR GROUND SIGNAGE

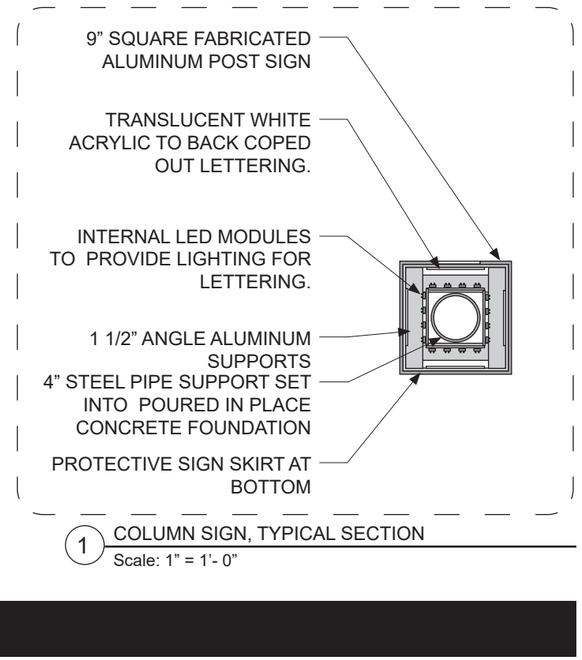
TYPE G, COLUMN POST ID

USE:
THIS SIGN IS INTENDED TO IDENTIFY AREAS FOR PARKING OR FOR SECONDARY IDENTITY LOCATIONS.

PLACEMENT:
IT'S STRIKING VERTICAL FORM IS USEFUL FOR VEHICULAR AND PEDESTRIAN ACCESS POINTS AND ADJACENT WALKWAYS.







1 COLUMN SIGN, TYPICAL SECTION
Scale: 1” = 1’- 0”

SIGN MESSAGING:
-ALL FINAL COPY AND SIGN CONTENT TO BE PROVIDED BY CPL.
-TYPESETTING OF ALL FACES OF ALL SIGNS TO BE BY THE SIGNAGE CONTRACTOR.
-ALL SIGN LAYOUTS BY THE SIGNAGE CONTRACTOR TO BE APPROVED BY CPL. PRIOR TO FABRICATION AND INSTALLATION.

SIGN FOUNDATIONS: FOUNDATIONS TO BE POURED IN PLACE CONCRETE. ANY EXPOSED PORTIONS TO HAVE A SMOOTH, FLAT TROWELED FINISH WITH NEAT CORNERS OR RADII.

SIGN CONSTRUCTION: ALL OUTDOOR SIGNS AND DISPLAY STRUCTURES SHALL BE DESIGNED AND CONSTRUCTED TO WITHSTAND THE WIND PRESSURES SPECIFIED IN THE CLEVELAND OHIO BUILDING CODE AND OBBC. REFERENCE CHAPTER 3133 OUTDOOR SIGNS AND DISPLAYS FOR ADDITIONAL INFORMATION.

3.2 EXTERIOR GROUND SIGNAGE

TYPE H, POST AND PANEL SIGN

USE:
THIS SIGN IS INTENDED TO IDENTIFY SPECIFIC REGULATORY AND OTHER SPECIAL OR CAUTIONARY CONDITIONS. BY VARYING THE SIGN PANEL LAYOUTS IT CAN BE USED FOR ADDITIONAL NEEDS.

PLACEMENT:
THIS SIGN TO BE LOCATED AT THE HEAD OF ACCESSIBLE PARKING SPOTS. *OTHER LAYOUTS WILL HAVE DIFFERENT LOCATION NEEDS.*

SIGN MESSAGING:

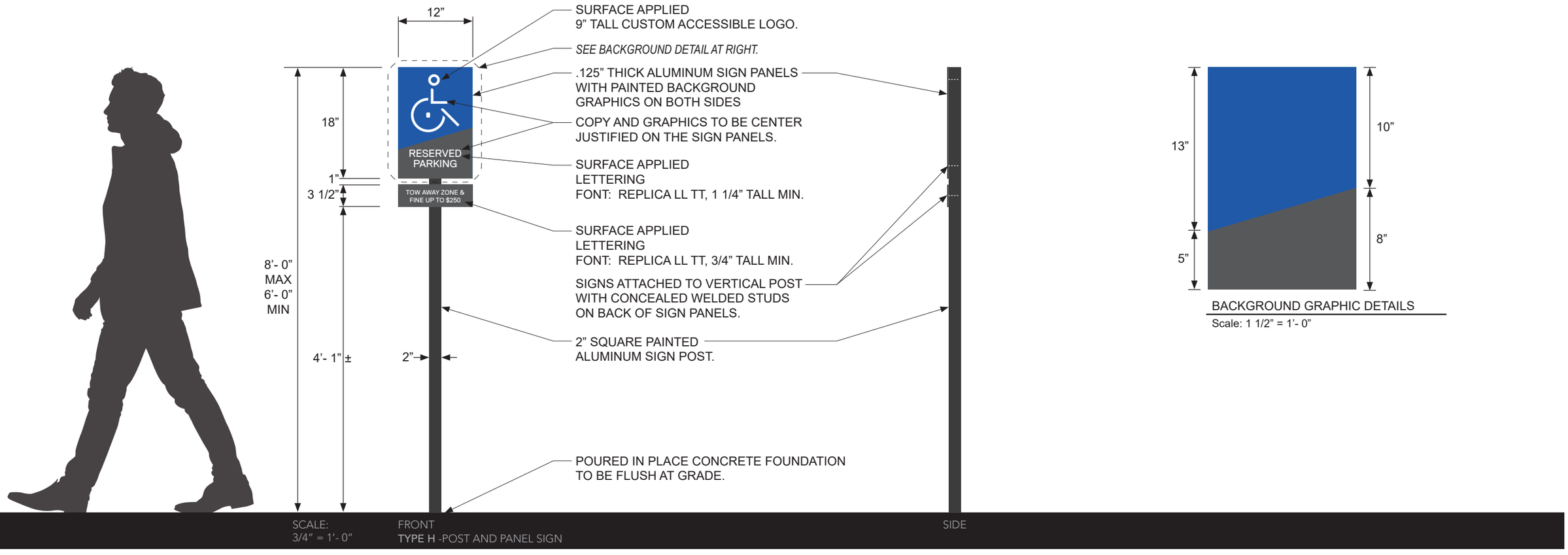
-ALL FINAL COPY AND SIGN CONTENT TO BE PROVIDED BY CPL.

-TYPESETTING OF ALL FACES OF ALL SIGNS TO BE BY THE SIGNAGE CONTRACTOR.

-ALL SIGN LAYOUTS BY THE SIGNAGE CONTRACTOR TO BE APPROVED BY CPL. PRIOR TO FABRICATION AND INSTALLATION.

SIGN FOUNDATIONS: FOUNDATIONS TO BE POURED IN PLACE CONCRETE. ANY EXPOSED PORTIONS TO HAVE A SMOOTH, FLAT TROWELED FINISH WITH NEAT CORNERS OR RADII.

SIGN CONSTRUCTION: ALL OUTDOOR SIGNS AND DISPLAY STRUCTURES SHALL BE DESIGNED AND CONSTRUCTED TO WITHSTAND THE WIND PRESSURES SPECIFIED IN THE CLEVELAND OHIO BUILDING CODE AND OBBC. REFERENCE CHAPTER 3133 OUTDOOR SIGNS AND DISPLAYS FOR ADDITIONAL INFORMATION.



BACKGROUND GRAPHIC DETAILS
Scale: 1 1/2" = 1'- 0"

3.2 EXTERIOR GROUND SIGNAGE

TYPE J, CHANGEABLE, TEMPORARY SIGN

USE:
THIS SIGN IS INTENDED FOR TEMPORARY USE TO HELP PROVIDE INFORMATION FOR SPECIAL EVENTS OR CONDITIONS AT EACH LIBRARY. THE FACES CAN BE CONFIGURED FOR A NUMBER OF USES.

PLACEMENT:
THIS SIGN CAN BE LOCATED ANYWHERE ON THE CAMPUS AND SHOULD BE STORED INSIDE WHEN NOT IN USE.

SIGN MESSAGING:

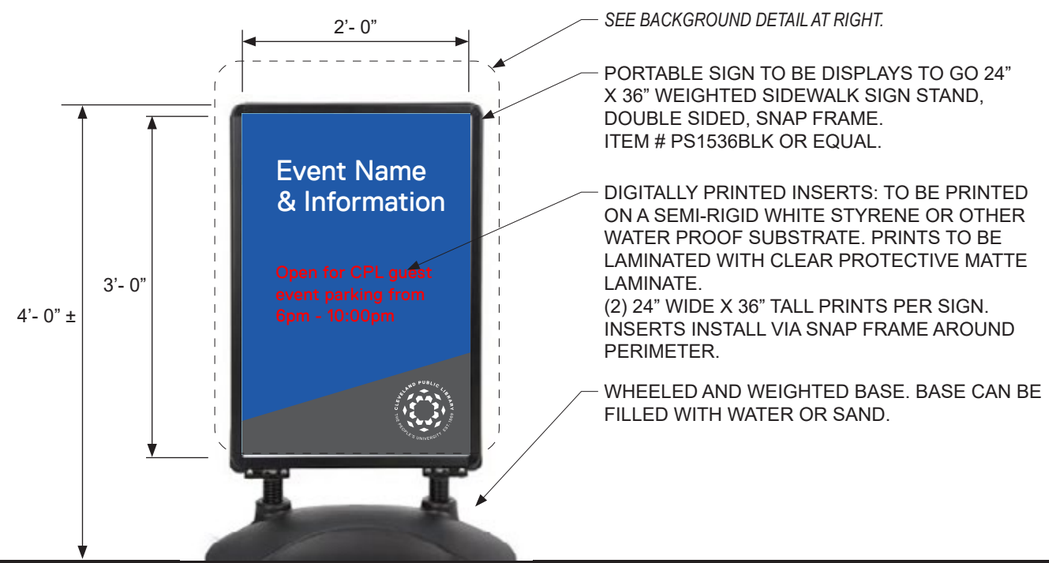
-ALL FINAL COPY AND SIGN CONTENT TO BE PROVIDED BY CPL.

-TYPESETTING OF ALL FACES OF ALL SIGNS TO BE BY THE SIGNAGE CONTRACTOR.

-ALL SIGN LAYOUTS BY THE SIGNAGE CONTRACTOR TO BE APPROVED BY CPL. PRIOR TO FABRICATION AND INSTALLATION.

SIGN CONSTRUCTION: ALL OUTDOOR SIGNS AND DISPLAY STRUCTURES SHALL BE DESIGNED AND CONSTRUCTED TO WITHSTAND THE WIND PRESSURES SPECIFIED IN THE CLEVELAND OHIO BUILDING CODE AND OBBC. REFERENCE CHAPTER 3133 OUTDOOR SIGNS AND DISPLAYS FOR ADDITIONAL INFORMATION.



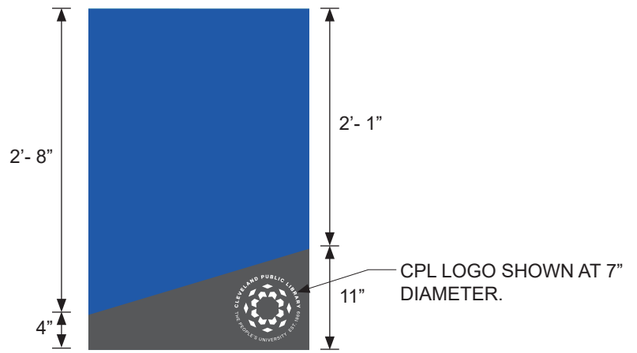


SEE BACKGROUND DETAIL AT RIGHT.

PORTABLE SIGN TO BE DISPLAYS TO GO 24" X 36" WEIGHTED SIDEWALK SIGN STAND, DOUBLE SIDED, SNAP FRAME.
ITEM # PS1536BLK OR EQUAL.

DIGITALLY PRINTED INSERTS: TO BE PRINTED ON A SEMI-RIGID WHITE STYRENE OR OTHER WATER PROOF SUBSTRATE. PRINTS TO BE LAMINATED WITH CLEAR PROTECTIVE MATTE LAMINATE.
(2) 24" WIDE X 36" TALL PRINTS PER SIGN.
INSERTS INSTALL VIA SNAP FRAME AROUND PERIMETER.

WHEELED AND WEIGHTED BASE. BASE CAN BE FILLED WITH WATER OR SAND.



BACKGROUND GRAPHIC DETAILS
Scale: 3/4" = 1'- 0"

SCALE:
3/4" = 1'- 0"

FRONT
TYPE J -CHANGEABLE, TEMPORARY SIGN

3.3 EXTERIOR BUILDING ID
ORIENTATION

PRIMARY ENTRANCE SIGN

As part of our continued effort to strengthen and unify the Cleveland Public Library brand across all campuses, each CPL building should incorporate the official CPL secondary logo lockup, either in its vertical or horizontal format, into the building's exterior design in a thoughtful and highly visible manner.

The logo lockup should be prominently displayed on the building facade, ideally located near the main or secondary public entrance. This placement reinforces brand recognition, establishes a consistent identity across all sites, and signals a welcoming presence to the surrounding community.

However, we recognize that architectural conditions, existing structures, and urban context may require flexibility. In cases where entrance-adjacent placement is not optimal due to sight lines, scale, or contextual constraints, the logo lockup may be located elsewhere on the building. In such instances, the same level of intentionality and design integrity must be maintained to ensure visibility and alignment with CPL's brand standards.

Designers should evaluate the following key criteria when determining logo placement:

1. **Visibility & Sight-lines:** Ensure the logo is clearly visible from prominent public viewpoints, including adjacent roadways, pedestrian paths, plazas, or gathering spaces. The goal is to make the brand recognizable from a distance and as people approach the building.

2. **Contrast:** The logo should maintain a minimum of 50% contrast from its background to ensure legibility. Consider how lighting, texture, and environmental factors may affect visibility throughout the day and year.

3. **Materiality:** Choose materials that are durable, appropriate to the building's aesthetic, and reflective of CPL's high standards. Material selection should complement the architectural design while maintaining brand integrity.

4. **Color:** Approved colors for the logo lockup include white, CPL blue, or a metallic finish. The final color choice should balance both visibility and architectural integration, while maintaining consistency with CPL's brand guidelines.

5. **Positive/Negative Execution:** Depending on the background surface and visibility needs, the logo may be executed as either a positive (standard) or negative (reversed) version to maximize clarity and visual impact.

By applying these standards with both creativity and consistency, each campus will reflect CPL's mission and values while reinforcing a strong and unified visual identity throughout the city.

HORIZONTAL SECONDARY LOGO LOCKUP



VERTICAL SECONDARY LOGO LOCKUP



3.3 EXTERIOR BUILDING ID
SCALING

PRIMARY ENTRANCE SIGN

Because CPL buildings employ a variety of façade materials and finishes, the brand lockup may not always align or fit perfectly at its standard scale. In some cases, maintaining the lockup at 100 % proportional size would compromise legibility or clash with architectural details.

Scaling Flexibility

1. The logo mark should be set first at the optimal size for the façade; the text can then be adjusted to clear reveals, projections, or other surface conditions.

2. The design team may enlarge the text portion of the lockup by up to 128%.

3. The spacing between the logo mark and text must remain constant in every configuration.

Construction & Installation Standards

1. **Durability** — Fabrication should ensure a service life of at least 6–7 years with no visible wear.

2. **Mounting Hardware** — Use non-oxidizing fasteners that do not compromise the façade warranty.

3. **Architectural Integrity** — Installation must not damage or void warranties on exterior materials.

4. Approvals

    - CPL Design Review Team (as part of overall building design submissions)
    - Cleveland City Planning Commission and/or Department of Building & Housing

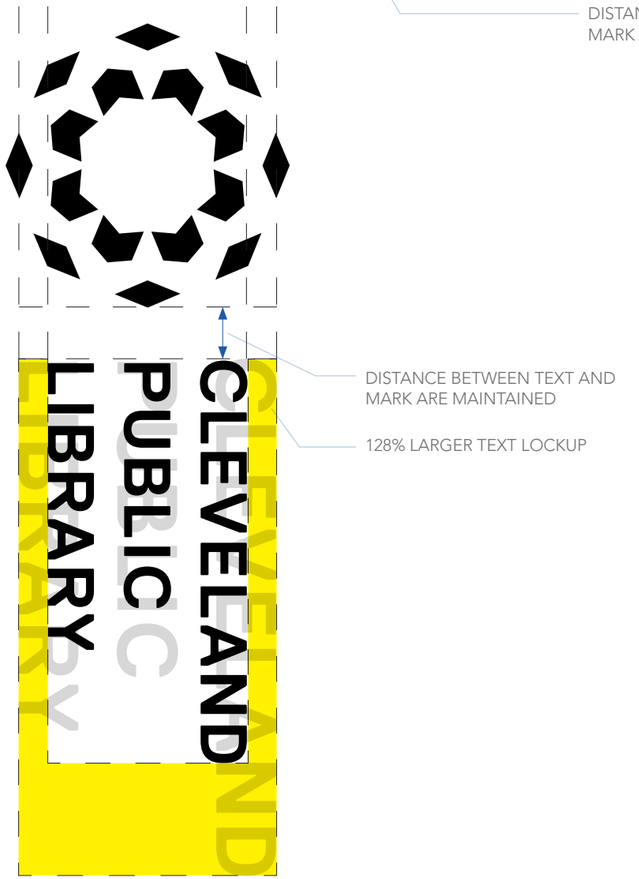
5. **Illumination** — Internally or externally lit signs are preferred but not required; lighting solutions are subject to CPL approval.

These standards ensure the CPL lockup remains visually clear, structurally sound, and harmonious with every building's unique architectural skin.

HORIZONTAL SECONDARY LOGO LOCKUP



VERTICAL SECONDARY LOGO LOCKUP



3.3 EXTERIOR BUILDING ID
EXAMPLE

PRIMARY ENTRANCE SIGN

In the example below the logo text lockup placed on the building facade was increased so that letters would not fall into the reveals of the building.

Due to timing of the installation the final execution of the logo was done in applied vinyl. This solution is rated for 6 - 7 years other solutions that would have been acceptable are as follows:

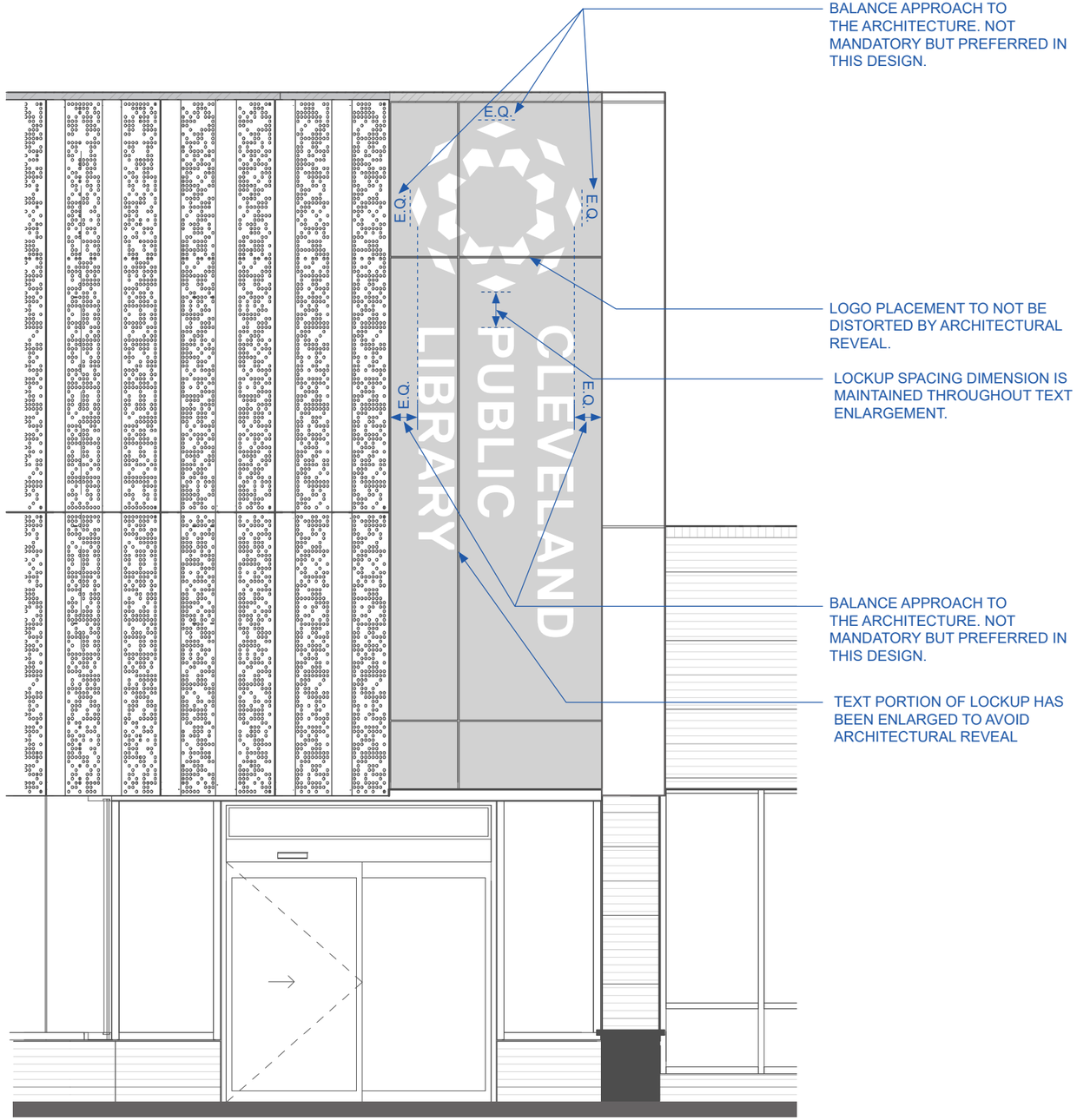
1. Cut through internally illuminated architectural panels
2. Low depth internally illuminated channel letters and shapes
3. Pin mounted plate letters with non-oxidizing fasteners



DESIGN RENDERING



COMPLETED PHOTO



A - NORTH ENTRY EXTERIOR SIGN

SCALE: N.T.S.

3.3 EXTERIOR BUILDING ID
PLANNING

PRIMARY ENTRANCE SIGN EXAMPLE

In this example, the secondary logo is shown in both horizontal and vertical orientations for CPL approval. Placement and spacing on the building should be carefully evaluated based on:

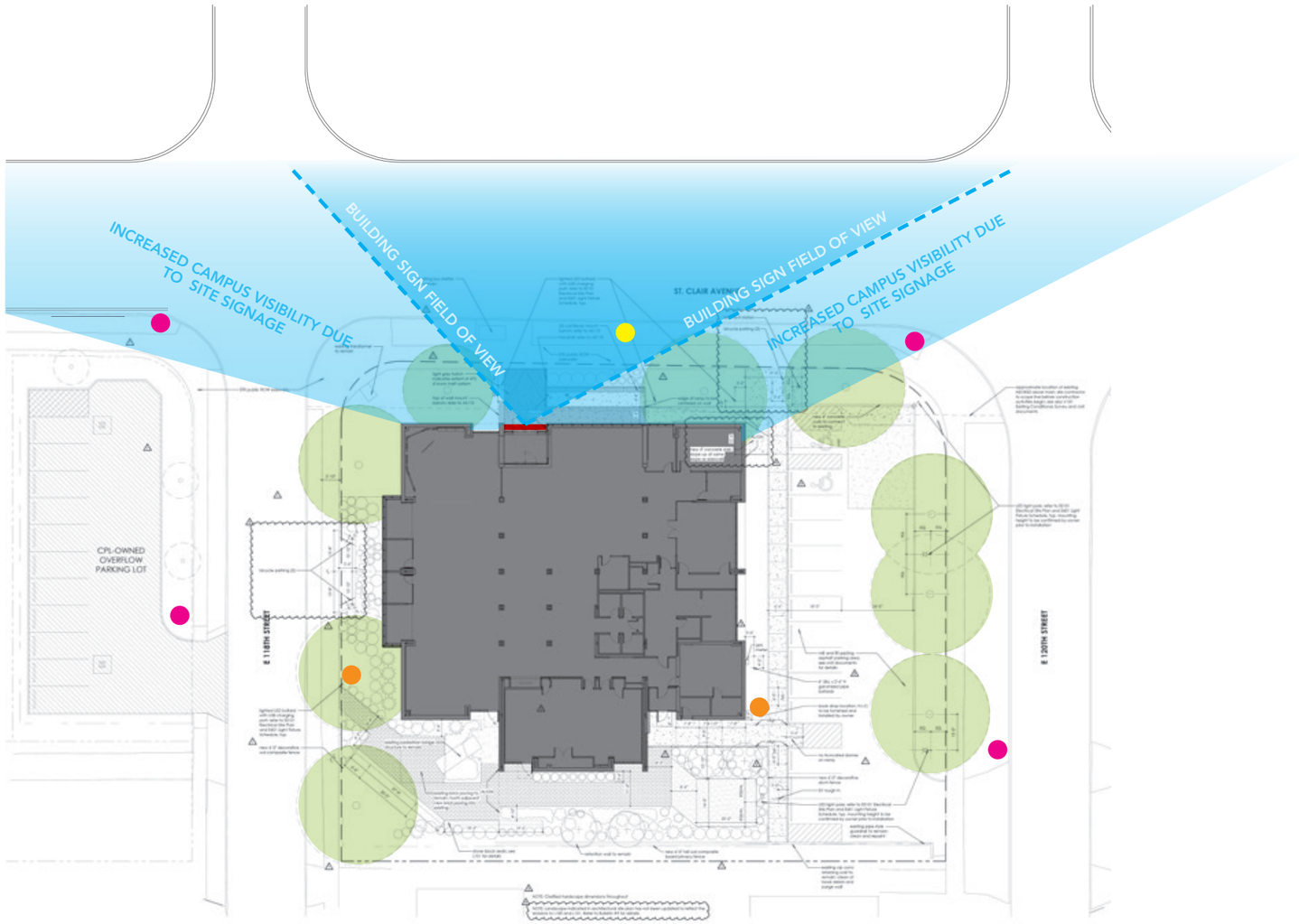
1. Sightlines from primary roadways
2. Distance (setback) from the roadway
3. Driver viewing angle (vertical and horizontal)
4. Architectural background material and contrast
5. Primary directions of traffic flow
6. Trees that may obstruct viewable distance

Site signage should also inform the location of the building identifier. When building-mounted signage is not within the line-of-sight for oncoming traffic in both directions, use strategically placed ground signage so drivers can identify the campus before their decision point.



DESIGN RENDERING

FIELD OF VIEW TO IDENTIFY THE LIBRARY



PRIMARY CAMPUS ID

SECONDARY CAMPUS DIRECTIONAL

PEDESTRIAN CAMPUS DIRECTIONAL

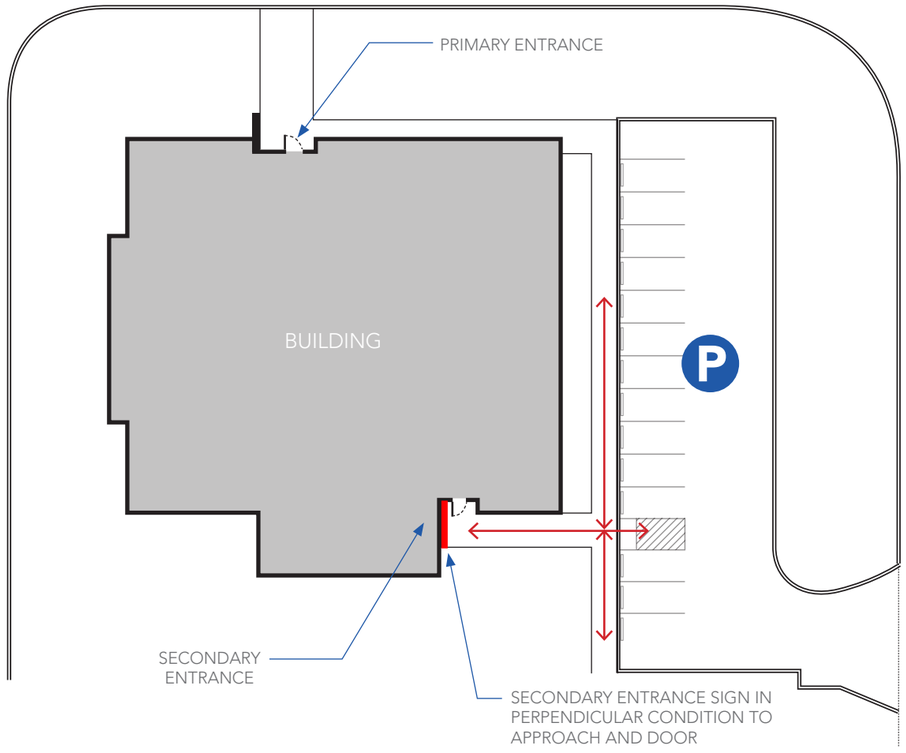
BUILDING ID

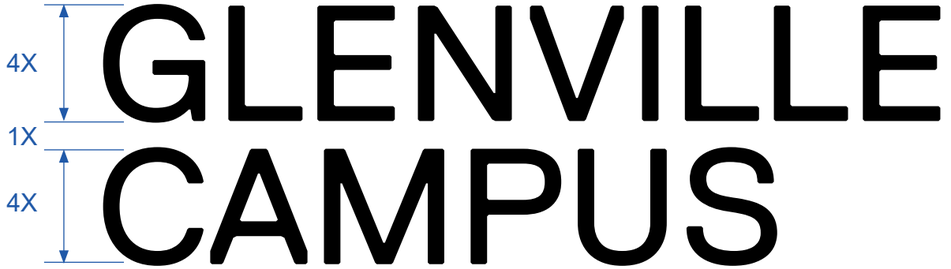
3.4 SECONDARY EXTERIOR BUILDING ID
ENTRANCE SIGN

SECONDARY & TERTIARY ENTRANCE SIGNS

When secondary entrances are present, campus-name identification may be required. In these cases:

1. **Copy:** Use the full campus name.
2. **Layout:** Match the left-justified format and text lock-up used at the primary entrance.
3. **Materiality:** Choose materials that are durable, appropriate to the building's aesthetic, and reflective of CPL's high standards. Material selection and color should complement the architectural design while maintaining brand integrity.
4. **Size:** Letter height should be no smaller than 8".
5. **Orientation:** Whenever feasible, position the sign perpendicular to the primary pedestrian approach—even if this makes it perpendicular to the secondary entrance door for adequate visibility. **SEE EXAMPLE BELOW**







3.4 SECONDARY EXTERIOR BUILDING ID
ENTRANCE SIGNS

SECONDARY & TERTIARY ENTRANCE SIGNS

When secondary entrances are present, campus-name identification may be required. In these cases:

1. **Copy:** Use the full campus name.

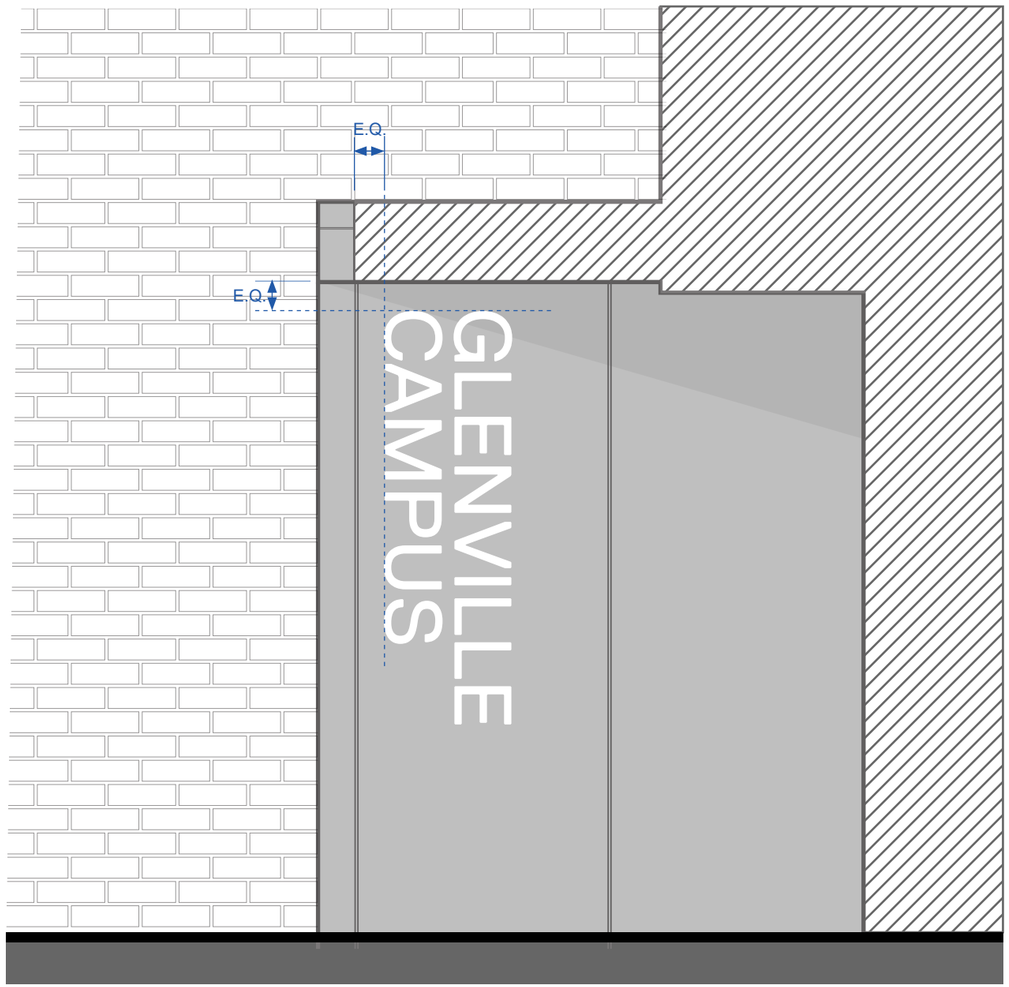
2. **Layout:** Match the left-justified format and text lock-up used at the primary entrance. **SEE FOLLOWING PAGE**

3. **Materiality:** Choose materials that are durable, appropriate to the building's aesthetic, and reflective of CPL's high standards. Material selection and color should complement the architectural design while maintaining brand integrity.

4. **Size:** Letter height should be no smaller than 8".

5. **Orientation:** Whenever feasible, position the sign perpendicular to the primary pedestrian approach—even if this makes it perpendicular to the secondary entrance door for adequate visibility. **SEE EXAMPLE BELOW**





3.5 ENTRANCE DOOR SIGNAGE
ENTRANCE DOOR & GLASS GRAPHICS

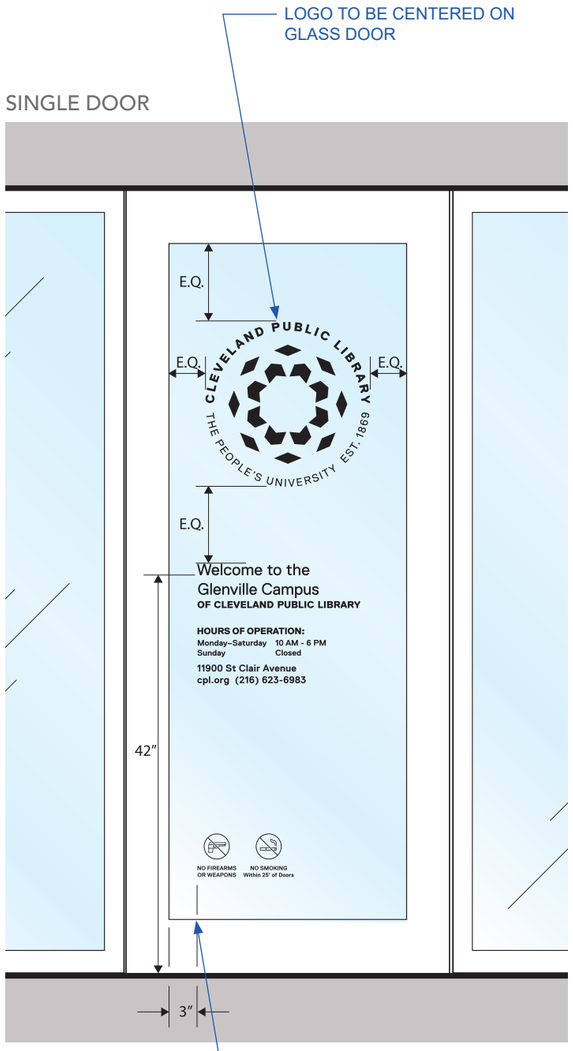
ENTRANCE DOOR SIGNAGE

All entrance doors should follow the same setup, execution and containing 4 components of information. This information is to be white second surface applied vinyl directly to glass for maximum viability at every entrance.

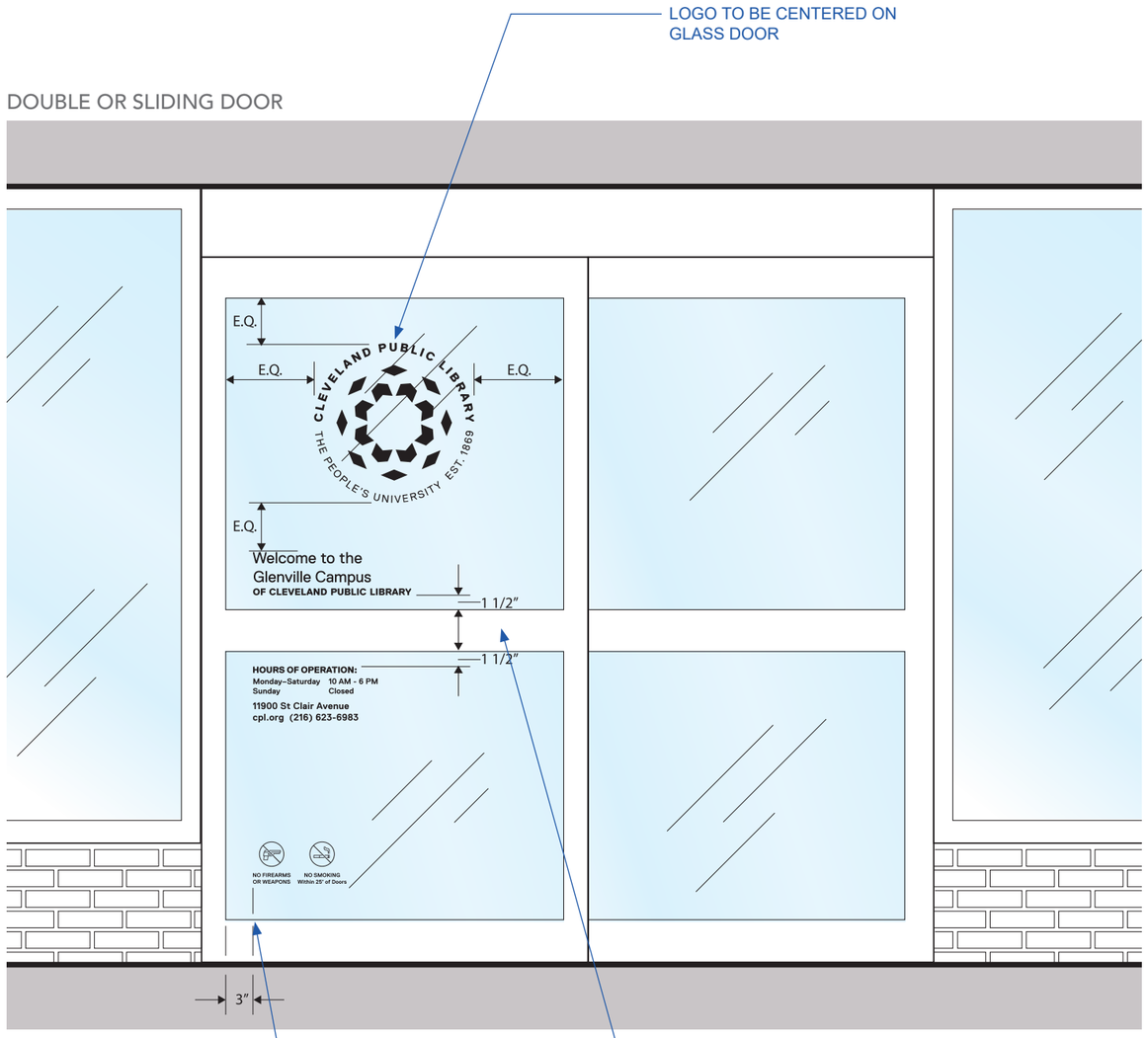
Entrance Door Info:

1. Primary CPL Logo
2. Welcome Copy
3. Hours of Operation
4. Prohibition Signs

SINGLE DOOR



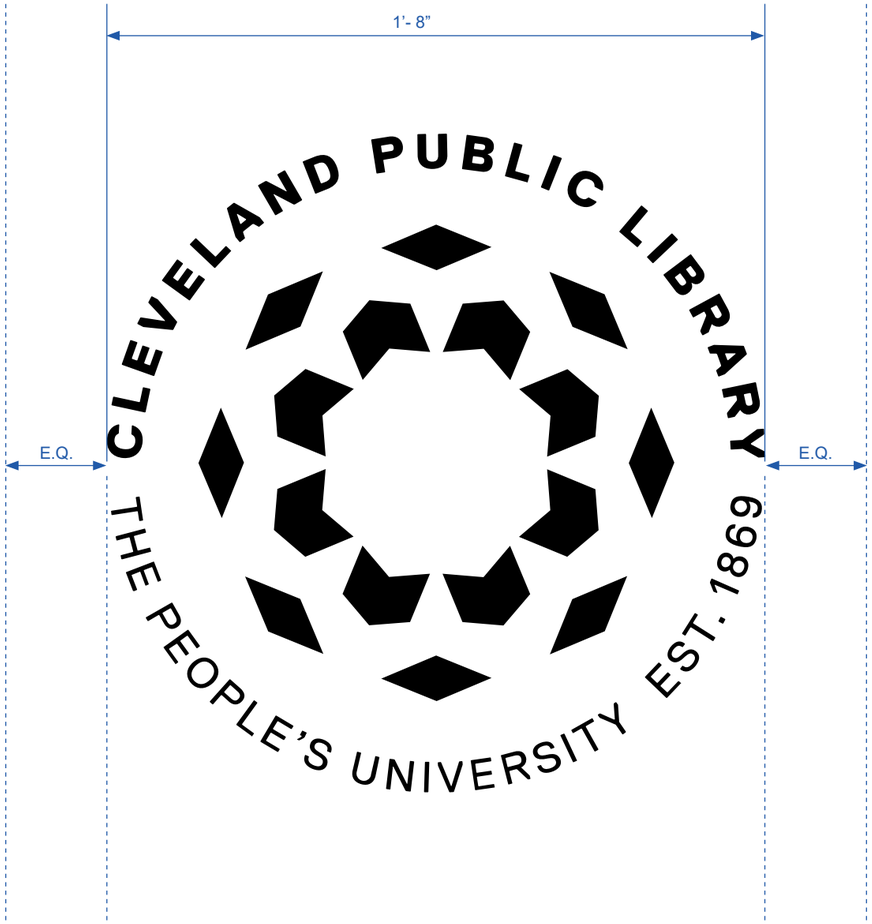
DOUBLE OR SLIDING DOOR

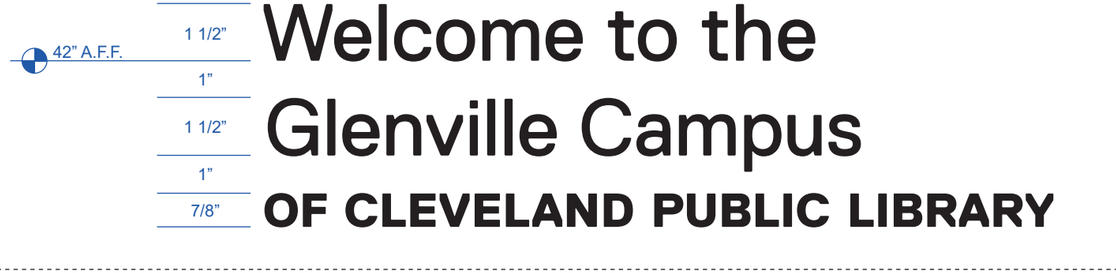


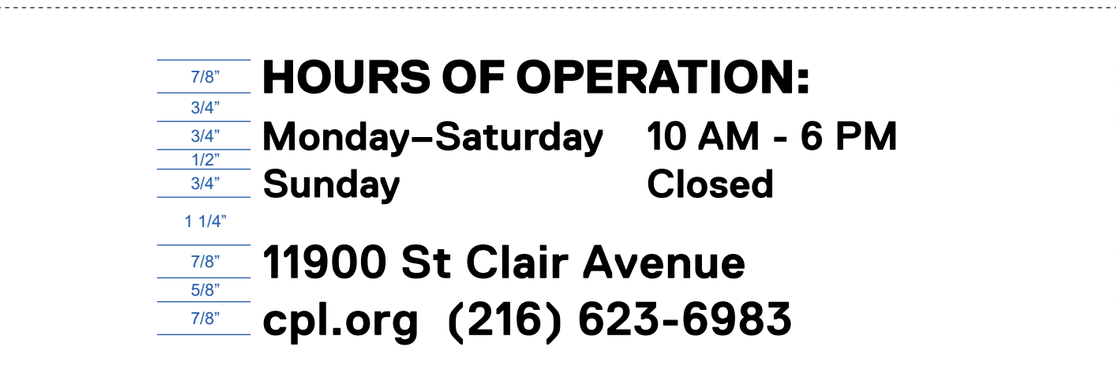
3.5 ENTRANCE DOOR SIGNAGE
ARTWORK LAYOUT

ENTRANCE DOOR SIGNAGE

Entrance door graphics must follow the standard dimensions listed in the chart below. Deviations are permitted only for unconventional door configurations and must receive prior approval from the CPL design team.









3.6 BUILDING ADDRESS NUMBERS
ENTRANCE DOOR & GLASS GRAPHICS

ENTRANCE ADDRESS NUMBERS

Entrance door address numbers are not only for patrons to locate the building but necessity for fire and rescue purposes. CPL Campus buildings should follow the criteria below to ensure address number legibility and in compliance with Ohio Fire Code OAC 1301:7-7-05 § 505.1 "Address identification".

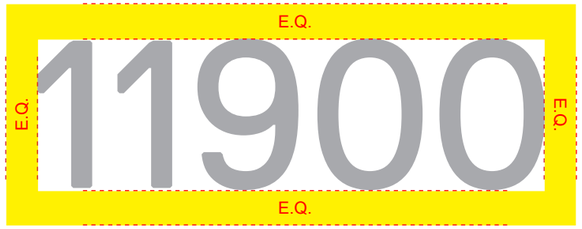
Location:

1. Locate the number on the public-facing side of the storefront (door, sidelights, transom, or an adjacent sign panel) where pedestrians and first responders can read it from the sidewalk or street.

Size it right:

1. Characters ≥ 4 in. high with a ½-in. stroke (larger is fine).
2. Use a contrasting color (e.g., white on dark glass or black on light masonry).
3. Font to be Replica Regular.

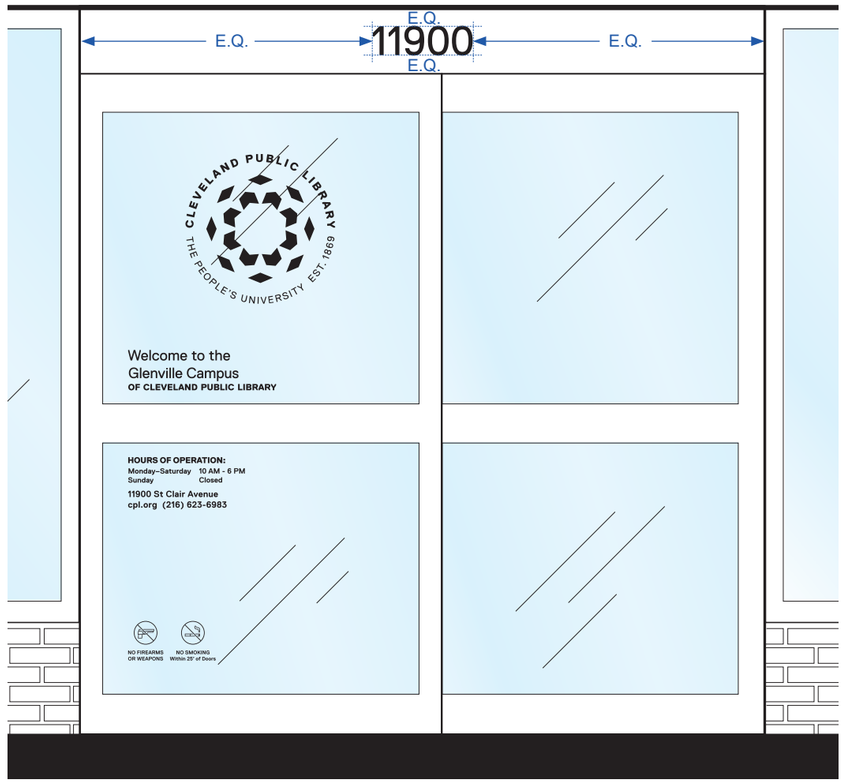
When architectural conditions permit, locate address numbers within sidelights or transoms and center them so they are equidistant from adjacent and perpendicular edges.



SINGLE DOOR



DOUBLE OR SLIDING DOOR



Hazardous Materials Survey

Site Location:

7724 Broadway Ave.
Cleveland, OH 44105



Prepared For:

Cleveland Public Library
325 Superior Ave. East
Cleveland, Ohio

Prepared By:

CTL Engineering of Ohio, Inc.
450 Grant St., Suite #110
Akron, OH 44311

CTL Project No. 26510080COL

June 12, 2026

CTL Engineering of Ohio, Inc.
450 Grant St., Suite #110; Akron, OH 44311
Phone: (330) 994-1590
email: ctl@ctleng.com

June 12, 2026

Cleveland Public Library
325 Superior Ave. East
Cleveland, Ohio

Attention: Mr. Eric Herman
Capital Projects Manager
Phone: 216-316-4083
E-mail: eric.herman@cpl.org

Reference: Hazardous Materials Survey
Site Name: Cleveland Public Library – Fleet Branch
Site Location: 7724 Broadway Ave., Cleveland, Ohio 44105
CTL Project No.: 26510080COL

Dear Mr. Herman:

In accordance with our contract, on behalf of **Cleveland Public Library** (Client), CTL Engineering of Ohio, Inc. performed a Hazardous Materials Survey of the Fleet Branch Library structure located at 7724 Broadway Ave. in Cuyahoga County, Cleveland, Ohio 44105.

If you should have any questions regarding the attached report, or require any further information, please feel free to contact our office at (614) 276-8123. Please refer to CTL Engineering Project No. **26510080COL** in all future inquiries. It was a pleasure working with you on this project and we sincerely appreciate your patronage.

Respectfully submitted,

CTL ENGINEERING OF OHIO, INC.

Matt McClelland, B.S.
Asbestos Hazard Evaluation Specialist #ES34598

TABLE OF CONTENTS

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2.0 INTRODUCTION 2

3.0 PROJECT SCOPE and SITE DESCRIPTION 2

4.0 ASBESTOS SURVEY METHODOLOGY 3

5.0 ASBESTOS SURVEY FINDINGS 5

6.0 LEAD-BASED PAINT 6

7.0 LIMITATIONS and EXCEPTIONS 6

APPENDICES

Appendix A – Site Photographs

Appendix B – Laboratory Reports / Chain-of-Custody Forms

Appendix C – Sample Locations Plan

Appendix D – XRF Readings

Appendix E – Certifications

1.0 EXECUTIVE SUMMARY

In accordance with our contract, on behalf of **Cleveland Public Library** (Client), CTL Engineering of Ohio, Inc. performed a Hazardous Materials Survey of the Fleet Branch Library structure located at 7724 Broadway Ave. in Cuyahoga County, Cleveland, Ohio 44105.

CTL surveyed the structure to identify Asbestos-Containing Materials (ACMs) and Lead-Based Paint that may require special handling prior to renovation of the structure. The information provided below is a brief summary of the findings and should be read in conjunction with the entire report.

Asbestos Survey

Mr. Matt McClelland, Ohio Asbestos Hazard Evaluation Specialist #34598 conducted the survey on May 28, 2026. A total of thirty-four (34) samples (not including all layers), representing fifteen (15) homogeneous areas, were collected and submitted to CEI / Eurofins of Cary, North Carolina, a NVLAP-certified laboratory, for analysis via Polarized Light Microscopy.

The following asbestos-containing materials (ACMs), i.e., containing >1% asbestos, were confirmed in association with the subject structure:

Homogeneous Area	Description	Location	Type	Condition	Estimated Quantity
3	Sink undercoating a/w metal sinks	Office, employee lounge & storage room	Category II Non-Friable	Good	3 sinks / 15 square-feet
10	12” beige/black floor tile	Storage room adjacent to meeting room	Category I Non-Friable	Good	25 square-feet
14	Built-up roofing	Penthouse rooftop	Category I Non-Friable	Good	500 square-feet
15	Silver roof paint	Penthouse rooftop, perimeter & around penetrations	Category II Non-Friable	Fair	350 square-feet

All asbestos-containing materials that will be disturbed during renovation activities should be removed and disposed of by a licensed asbestos abatement contractor in accordance with the Asbestos NESHAPS, 40 CFR Part 61, and the OSHA Asbestos in Construction Standard, 29 CFR 1926.1101 and all applicable federal, state and local asbestos regulations.

No asbestos was detected in any of the remaining samples collected during this assessment, when analyzed using Polarized Light Microscopy (PLM) (EPA Method 600\R-93\116).

Lead-Based Paint

A total of thirty-one (31) representative painted/coated surfaces were tested for lead content utilizing a hand-held X-Ray Fluorescence Analyzer (XRF), which provides a non-destructive quantitative field evaluation of lead content. None of the XRF readings identified lead content equal or greater than the EPA regulatory threshold for lead-based paint of 1.0 mg/cm^2.

However, six (6) of the painted surfaces exhibited detectable lead concentrations below the EPA regulatory threshold for lead-based paint.

Note that OSHA does not recognize XRF or paint chip sampling results as a method of validating lead concentrations in paint to determine potential workers' exposure and that it considers any paint with quantity of detectable lead to be lead containing, and thus regulated. Consequently, personal air sampling during paint abatement or disturbing activities is the only way to determine worker's exposure for OSHA compliance.

Therefore, contractors should be notified that the OSHA Lead-in Construction Standard (29 CFR 1926.62) applies to all contractors involved in demolition or renovation activities that may disturb existing painted or coated substrates. Contractors that disturb the paint are responsible for complying with all aspects of the OSHA Lead in Construction Standard.

2.0 INTRODUCTION

In accordance with our contract, on behalf of **Cleveland Public Library** (Client), CTL Engineering of Ohio, Inc. performed a Hazardous Materials Survey of the Fleet Branch Library structure located at 7724 Broadway Ave. in Cuyahoga County, Cleveland, Ohio 44105.

CTL surveyed the structure to identify Asbestos-Containing Materials (ACMs) and Lead-Based Paint that may require special handling prior to renovation of the structure.

Site photographs are included in **Appendix A**, the laboratory reports and chain-of-custody documents are included in **Appendix B**, a sample locations plan is included in **Appendix C**, a table of XRF readings for lead-based paint is included in **Appendix D**, and the accreditations of the individual who performed the survey is included in **Appendix E**.

3.0 PROJECT SCOPE AND SITE DESCRIPTION

This Hazardous Materials Survey was conducted to determine the type, quantity, condition, and the potential for disturbance of suspected ACMs used in the construction of the subject building, as well as an investigation of the subject building for Lead-Based Paint that may require special handling prior to renovation of the structure.

The subject structure is located at 7724 Broadway Avenue in Cleveland, OH 44105. Based on information provided in the Cuyahoga County Auditor's website, the one-story building (in addition to a 500 square-foot 2nd floor penthouse) consists of slab-on-grade construction, comprises 9,402 square feet of interior space, and was constructed in 1980.

4.0 ASBESTOS SURVEY METHODOLOGY

This asbestos survey were conducted in accordance with the applicable regulations and general guidelines set forth in EPA's *Asbestos Hazardous Emergency Response Act* (AHERA) and rules promulgated under 40 CFR 763, Subpart E.

Specifically, the project included the following tasks:

- Review of existing building plans and/or drawings, previous asbestos survey reports and related information indicating the presence or location of ACMs in the building, if available. Existing building plans were provided by the Client, but no previous asbestos survey reports were provided.

- Survey of the building planned for renovation by a licensed Asbestos Hazard Evaluation Specialist(s), as per regulations under OAC 3701:34. The survey included a thorough visual and physical examination of building materials to identify locations of known and/or suspect ACMs.

- Suspect materials were classified as homogeneous according to their installation date, color, texture, and/or hardness as suggested by current EPA sampling protocols. The suspect materials were then divided into Homogeneous Areas (HAs) and each sample collected was identified with a unique sample identifier.

- The number of samples collected from each type of suspect material was determined according to the following criteria:

  Surfacing Materials: The number of samples and sample locations were determined according to the EPA guidance publication, *Simplified Sampling Scheme for Friable Surfacing Materials* (EPA 560/5-85-030a, October, 1985), a recommended number of 9 samples per HA or a minimum of 3, 5, or 7 based on the square footage of each HA.

  Thermal System Insulation Materials: The number of samples and sample locations were determined according to the quantity of the material observed, and the Asbestos Hazard Evaluation Specialist's judgment on the homogeneity of the insulation materials, based on field observations. Materials such as fiberglass and foam insulation are not considered suspect of containing asbestos, and, therefore, were not sampled.

  Miscellaneous Materials: The number of samples and sample locations were determined according to the quantity of the material observed and the Asbestos Hazard Evaluation Specialist's judgment on the homogeneity of the material. Samples are collected "in a manner sufficient to determine whether the material is ACM or not ACM" in accordance with 40 CFR Part 763.86 (c-d).

- Bulk samples were collected directly from exposed materials. Prior to sample collection, the surface was sprayed with a surfactant to reduce the potential for fiber release. A complete core or cross-section sample of each material was taken to ensure that each layer of suspect ACM was representative of the parent material. The samples were carefully placed in a labeled sample container and sealed, and the information recorded onto a chain-of-custody form. In addition, sampling locations were noted and suspect materials were photographed.

- Since the building was still occupied, destructive sampling was not performed during the survey. Suspect materials in concealed areas that are identified via site observations and/or a review of the existing construction drawings are presumed to contain asbestos when not accessible for sampling.

- Appropriate safety precautions were taken, where and when necessary, such as the use of protective clothing/equipment (half-face respirator, latex gloves, etc.).

Condition Assessment

A condition assessment for each confirmed asbestos-containing material is provided based upon the condition of the material as observed during the survey. The condition of each material is determined according to the following criteria:

General Damage Criteria	Criteria
Good	Not damaged
Fair	Up to 10% overall / 25% localized damage
Poor	Over 10% overall / 25% localized damage

Sample Analysis

- All samples were initially analyzed in a laboratory accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) using Polarized Light Microscopy (PLM) and dispersion-staining techniques (EPA Method 600\R-93\116) according to the protocol outlined in 40 CFR 763, Appendix A to Subpart F.

- Because the PLM method has been known to provide false positive or false negative results at low asbestos concentrations, i.e., less than 1%, low asbestos results cannot be guaranteed. Therefore, when asbestos concentrations are reported at less than 1% in friable materials, additional sample analysis using the more accurate Point Count Method is conducted.

- In some cases, particularly where there is little question about the homogeneity of samples collected from a Homogeneous Area, if the first sample analyzed from the Homogeneous Area is positive, the remaining samples may be assumed to contain asbestos and not be analyzed.

- A Homogeneous Area is determined to contain no asbestos when all the samples from the Homogeneous Area are analyzed via PLM method and found to contain no asbestos. If all samples collected from a Homogeneous Area exhibit no asbestos content when analyzed via PLM, no additional analysis is conducted.

- If any sample from a Homogeneous Area is found to contain asbestos, the entire Homogeneous Area must be assumed to contain asbestos unless additional analysis by Point Count or TEM is conducted, or if additional assessment and sampling can further delineate the extent of the ACMs within the Homogeneous Area.

5.0 ASBESTOS SURVEY FINDINGS

Mr. Matt McClelland, Ohio Asbestos Hazard Evaluation Specialist #34598 conducted the survey on May 28, 2026. A total of thirty-four (34) samples (not including all layers), representing fifteen (15) homogeneous areas, were collected and submitted to CEI / Eurofins of Cary, North Carolina, a NVLAP-certified laboratory, for analysis via Polarized Light Microscopy.

Please note that several of the samples had multiple layers that were separated by the analytical laboratory for analysis, as required by OSHA and EPA analytical protocols. Consequently, the total number of samples analyzed does not match the total number of samples collected during the survey.

The following asbestos-containing materials (ACMs), i.e., containing >1% asbestos, were confirmed in association with the subject structure:

Homogeneous Area	Description	Location	Type	Condition	Estimated Quantity
3	Sink undercoating a/w metal sinks	Office, employee lounge & storage room	Category II Non-Friable	Good	3 sinks / 15 square-feet
10	12” beige/black floor tile	Storage room adjacent to meeting room	Category I Non-Friable	Good	25 square-feet
14	Built-up roofing	Penthouse rooftop	Category I Non-Friable	Good	500 square-feet
15	Silver roof paint	Penthouse rooftop, perimeter & around penetrations	Category II Non-Friable	Good	350 square-feet

All asbestos-containing materials that will be disturbed during renovation activities should be removed and disposed of by a licensed asbestos abatement contractor in accordance with the Asbestos NESHAPS, 40 CFR Part 61, and the OSHA Asbestos in Construction Standard, 29 CFR 1926.1101 and all applicable federal, state and local asbestos regulations.

No asbestos was detected in any of the remaining samples collected during this assessment, when analyzed using Polarized Light Microscopy (PLM) (EPA Method 600\R-93\116).

6.0 LEAD-BASED PAINT

Mr. Matt McClelland, Ohio Lead Inspector / Risk Assessor #LA007913 conducted the survey on May 28, 2026. A total of thirty-one (31) representative painted/coated surfaces were tested for lead content utilizing a hand-held X-Ray Fluorescence Analyzer (XRF), which provides a non-destructive quantitative field evaluation of lead content. None of the XRF readings identified lead content equal or greater than the EPA regulatory threshold for lead-based paint of 1.0 mg/cm^2.

However, six (6) of the painted surfaces exhibited detectable lead concentrations below the EPA regulatory threshold for lead-based paint.

Note that OSHA does not recognize XRF or paint chip sampling results as a method of validating lead concentrations in paint to determine potential workers' exposure and that it considers any paint with quantity of detectable lead to be lead containing, and thus regulated. Consequently, personal air sampling during paint abatement or disturbing activities is the only way to determine worker's exposure for OSHA compliance.

Therefore, contractors should be notified that the OSHA Lead-in Construction Standard (29 CFR 1926.62) applies to all contractors involved in demolition or renovation activities that may disturb existing painted or coated substrates. Contractors that disturb the paint are responsible for complying with all aspects of the OSHA Lead in Construction Standard.

7.0 LIMITATIONS AND EXCEPTIONS

7.1 CTL Engineering has prepared this report for your use, in accordance with generally accepted practices and industry and professional standards applicable to similar work. The information obtained in this report is site-specific and pertains to this project only.

7.2 The assessment of the building was limited to the aforementioned subject building planned for renovation, and no destructive sampling was performed to investigate concealed spaces within walls, beneath floors, or above ceilings.

7.3 The conclusions provided in this report are based on data collected from individual bulk sampling locations. Conditions between bulk sample locations may vary and it should not be expected that they will be precisely represented by any one bulk sample. In the event that any previously unidentified suspect ACMs are encountered, those materials should be sampled and assessed by a licensed Asbestos Hazard Evaluation Specialist or assumed to contain asbestos and treated accordingly. If any additional ACMs are discovered, only properly trained and licensed personnel should perform work activities that may disturb these materials.

7.4 Although this proprietary report was prepared for the exclusive use of **Cleveland Public Library** (Client), it may be relied upon by any applicable federal, state, and local government regulatory agencies, provided that CTL Engineering is also informed, in writing, and that the use of the report is subject to the limitations and exceptions set forth in the report, as well as the terms and conditions contained in the original contract documents signed by CTL Engineering and the Client.

CTL Engineering will not distribute or publish this proprietary report to any third party without the Client's written consent, except as required by law or a court order. Any unauthorized use of or reliance on this report by any third party shall release CTL Engineering from any liability resulting from such use or reliance.

7.5 Bulk asbestos samples will be retained in the laboratory for thirty (30) days from the date of their analysis, after which, these will be discarded, unless otherwise instructed by the Client. This asbestos survey covered the building materials of the referenced structures/areas, with the exception of the inaccessible portions as previously noted. The liability of CTL Engineering, with regard to professional error and omissions, cannot be in excess of the fee charged for this project.

7.6 This report, including the estimated quantities provided herein, is not intended for use in lieu of Asbestos Abatement Design Specifications for the solicitation of abatement bids. Abatement contractors shall visit the site and prepare their own estimates of ACM quantities prior to submitting abatement bids.

7.7 The opinions expressed in this report are based on CTL Engineering's experience, review of previous reports, and other information, if made available. This survey evaluated the conditions that existed at the time of investigation of the project areas, and does not warrant against future alteration of conditions at the subject site, or subsequent changes in environmental regulations. CTL Engineering has prepared this report for your use, in accordance with generally accepted hazardous material survey practices.

We appreciate the opportunity to provide you with these professional services. If you should have any questions, or need further information, please feel free to contact our office. Please refer to CTL Engineering Project No. 26510080COL in all correspondence and inquiries.

Respectfully submitted,

CTL ENGINEERING of OHIO, INC.

Matt McClelland, B.S.
Ohio Asbestos Hazard Evaluation
Specialist No. ES34598

Chris Rittenhouse, B.S.
Ohio Asbestos Project Designer No. 60808
(Technical Review)

APPENDIX A - SITE PHOTOGRAPHS



Photo 1 – Exterior overview of the Cleveland Public Library – Fleet Branch building, located at 7724 Broadway Avenue in Cleveland, Ohio.



Photo 2 – Another exterior overview of the Cleveland Public Library – Fleet Branch building.



Photo 3 – Overview of the built-up roof section above the mechanical penthouse portion of the building.



Photo 4 – Typical view of the computer lab within the library.



Photo 5 - Typical view of the reading room and main stacks within the library.



Photo 6 – Typical view of the employee lounge within the library.

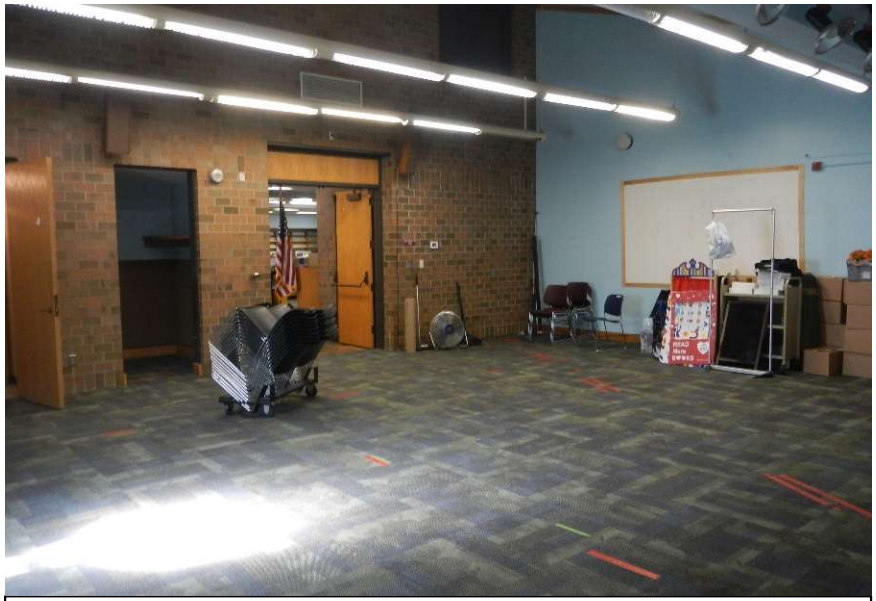

Photo 7 – Typical view of the meeting room within the library.



Photo 8 – Typical view of a customer restroom within the library.

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Photo 9 - Typical view of the penthouse mechanical room within the library.

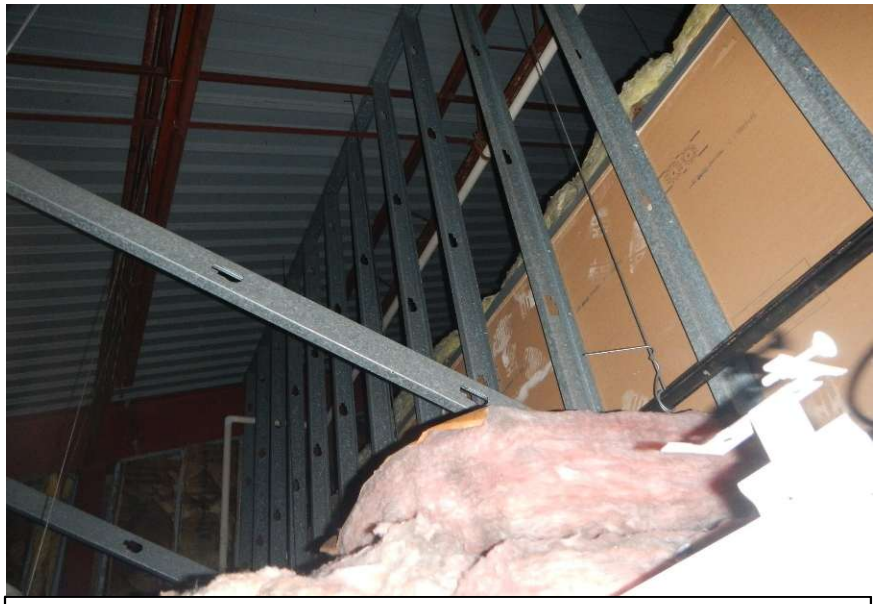

Photo 10 – Typical view above lay-in ceiling tiles within the library.



Photo 11 – Typical view of fiberglass pipe insulation within the library.



Photo 12 – Homogeneous Area (HA) #1, drywall / joint compound. **Refer to Sample Location Plan in Appendix C for sample locations.**



Photo 13 – HA #2, lay-in ceiling tile.



Photo 14 – **HA #3, asbestos-containing undercoating** on three metal sinks- in employee lounge, office, and storage room adjacent to meeting room.



Photo 15 – HA #4, tan carpet adhesive.



Photo 16 – HA #5, black window/door caulk.



Photo 17 – HA #6, tan ceramic tile mastic.



Photo 18 – HA #7, 12” tan mottled floor tile; and HA #8, brown cove base.



Photo 19 – HA #9, brown exterior caulk.



Photo 20 – HA #10, **asbestos-containing 12” beige/black floor tile** in storage room adjacent to the meeting room.



Photo 21 – HA #11, brown drywall / joint compound.



Photo 22 – HA #12, gray spray-on fireproofing.



Photo 23 – HA #13, gray roof caulk.



Photo 24 – **HA #14, asbestos-containing built-up roofing** above mechanical room penthouse.



Photo 25 – Another view of **HA #14, asbestos-containing built-up roofing.**



Photo 26 – Close-up view of **HA #14, asbestos-containing built-up roofing.**



Photo 27 – Typical view of roof core patch, and **HA #15, asbestos-containing silver paint** on mechanical room penthouse rooftop.

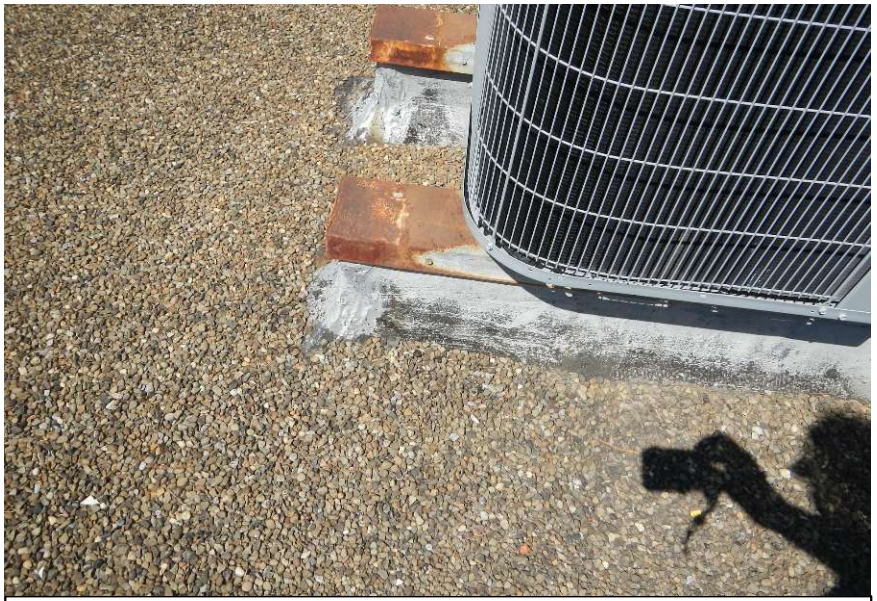

Photo 28 – Another view of **HA #15, asbestos-containing silver paint.**

APPENDIX B - LAB REPORTS & CHAIN OF CUSTODY FORMS

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June 02, 2026

Matt McClelland
CTL Engineering, Inc (OH)
2860 Fisher Road
Columbus, OH 43204

CLIENT PROJECT: Fleet Library 26510080COL
LAB CODE: 754502-1

Dear Matt,

Enclosed are asbestos analysis results for PLM Bulk samples received at our laboratory on 05/29/26. The samples were analyzed for asbestos using polarizing light microscopy (PLM) per the EPA 600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials and EPA 40 CFR Appendix E to Subpart E of Part 763: Interim Method of the Determination of Asbestos in Bulk Insulation Samples.

Sample results containing >1% asbestos are considered asbestos-containing materials (ACMs) per EPA regulatory requirements. The detection limit for the EPA 600 Method is <1% by calibrated visual estimate.

Thank you for your business and we look forward to continuing good relations.

Kind Regards,

Kamila Reichert

Kamila Reichert,
Laboratory Director

NVLAP 101768-0

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ASBESTOS ANALYTICAL REPORT
By: Polarized Light Microscopy

Prepared for

CTL Engineering, Inc (OH)

CLIENT PROJECT:	Fleet Library 26510080COL
LAB CODE:	754502-1
TEST METHOD:	EPA 600 / R93 / 116 and EPA 40 CFR Appendix E to Subpart E of Part 763
REPORT DATE:	06/02/26
TOTAL SAMPLES ANALYZED:	40
# SAMPLES >1% ASBESTOS:	7
TOTAL LAYERS ANALYZED:	55

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Asbestos Report Summary
By: Polarized Light Microscopy

Project: Fleet Library 26510080COL **Lab Code:** 754502-1

Method: EPA 600 / R93 / 116 and EPA 40 CFR Appendix E to Subpart E of Part 763

Client ID	Lab ID	Layer	Sample Description	Asbestos %
1A	4483426	Layer A	White joint compound	None Detected
		Layer B	White drywall	None Detected
			Composite (Composited Layers: B, A)	0%
1B	4483427	Layer A	White joint compound	None Detected
		Layer B	White drywall	None Detected
			Composite (Composited Layers: A, B)	0%
1C	4483428	Layer A	White joint compound	None Detected
		Layer B	White drywall	None Detected
			Composite (Composited Layers: A, B)	0%
2A	4483429		White ceiling tile	None Detected
2B	4483430		White ceiling tile	None Detected
3A	4483431		Pink sink undercoating	Chrysotile 5%
3B	4483432		Pink sink undercoating	Chrysotile 5%
4A	4483433		Tan carpet adhesive	None Detected
4B	4483434		Tan carpet adhesive	None Detected
5A	4483435		Black caulk	None Detected
5B	4483436		Black caulk	None Detected
6A	4483437		Tan ceramic tile mastic	None Detected
6B	4483438		Tan ceramic tile mastic	None Detected
7A	4483439		Light-brown floor tile	None Detected
7A (2)	4491318		Tan mastic	None Detected
7B	4483440		Light-brown floor tile	None Detected
7B (2)	4491326		Tan mastic	None Detected
8A	4483441		Brown cove base	None Detected
8A (2)	4491344		Tan mastic	None Detected
8B	4483442		Brown cove base	None Detected

Asbestos Report Summary
By: Polarized Light Microscopy

Project: Fleet Library 26510080COL **Lab Code:** 754502-1

Method: EPA 600 / R93 / 116 and EPA 40 CFR Appendix E to Subpart E of Part 763

Client ID	Lab ID	Layer	Sample Description	Asbestos %
8B (2)	4491345		Tan mastic	None Detected
9A	4483443		Brown caulk	None Detected
9B	4483444		Brown caulk	None Detected
10A	4483445		Beige/black floor tile	Chrysotile 2%
10A (2)	4491507		Tan mastic	None Detected
10B	4483446		Beige/black floor tile	Chrysotile 2%
10B (2)	4491508		Tan mastic	None Detected
11A	4483447	Layer A	White joint compound	None Detected
		Layer B	Brown drywall	None Detected
			Composite (Composited Layers: A, B)	0%
11B	4483448	Layer A	White joint compound	None Detected
		Layer B	Brown drywall	None Detected
			Composite (Composited Layers: A, B)	0%
12A	4483449		Gray fireproofing	None Detected
12B	4483450		Gray fireproofing	None Detected
12C	4483451		Gray fireproofing	None Detected
12D	4483452		Gray fireproofing	None Detected
12E	4483453		Gray fireproofing	None Detected
13A	4483454	Layer A	Brown/cream roofing caulk	None Detected
		Layer B	Gray roofing caulk	None Detected
13B	4483455	Layer A	Brown/cream roofing caulk	None Detected
		Layer B	Gray roofing caulk	None Detected
14A	4483456	Layer A	Black roofing	None Detected
		Layer B	Brownish-black roofing	Chrysotile 20%
		Layer C	Black paper w/ yellow foam	None Detected
		Layer D	Brown fibrous material	None Detected

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Asbestos Report Summary
By: Polarized Light Microscopy

Project: Fleet Library 26510080COL **Lab Code:** 754502-1

Method: EPA 600 / R93 / 116 and EPA 40 CFR Appendix E to Subpart E of Part 763

Client ID	Lab ID	Layer	Sample Description	Asbestos %
14B	4483457	Layer A	Black roofing	None Detected
		Layer B	Brownish-black roofing	None Detected
		Layer C	Black paper w/ yellow foam	None Detected
		Layer D	Brown fibrous material	None Detected
15A	4483458	Layer A	Silver roofing paint	Chrysotile 2%
		Layer B	Black roofing tar material	Chrysotile 7%
15B	4483459	Layer A	Silver roofing paint	Chrysotile 2%
		Layer B	Black roofing tar material	Chrysotile 7%

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ASBESTOS BULK ANALYSIS
By: Polarized Light Microscopy

Client: CTL Engineering, Inc (OH)
2860 Fisher Road
Columbus, OH 43204

Lab Code: 754502-1
Date Received: 05/29/26
Date Analyzed: 06/02/26
Date Reported: 06/02/26

Project: Fleet Library 26510080COL

Method: ASBESTOS BULK PLM, EPA 600 METHOD

Client ID / Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS Fibrous		Non-Fibrous		ASBESTOS %
1A	Joint Compound	Heterogeneous	2%	Cellulose	3%	Paint	**None Detected**
Layer A		White			80%	Calc Carb	
4483426		Non-Fibrous			15%	Binder	
		Bound					
Layer B	Drywall	Heterogeneous	10%	Cellulose	90%	Gypsum	**None Detected**
4483426		White					
		Non-Fibrous					
		Bound					
				Composite (Composited Layers: B, A)			**0%**
1B	Joint Compound	Heterogeneous	2%	Cellulose	3%	Paint	**None Detected**
Layer A		White			80%	Calc Carb	
4483427		Non-Fibrous			15%	Binder	
		Bound					
Layer B	Drywall	Heterogeneous	10%	Cellulose	90%	Gypsum	**None Detected**
4483427		White					
		Non-Fibrous					
		Bound					
				Composite (Composited Layers: A, B)			**0%**
1C	Joint Compound	Heterogeneous	2%	Cellulose	3%	Paint	**None Detected**
Layer A		White			80%	Calc Carb	
4483428		Non-Fibrous			15%	Binder	
		Bound					
Layer B	Drywall	Heterogeneous	10%	Cellulose	90%	Gypsum	**None Detected**
4483428		White					
		Non-Fibrous					
		Bound					
				Composite (Composited Layers: A, B)			**0%**

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ASBESTOS BULK ANALYSIS
By: Polarized Light Microscopy

Client: CTL Engineering, Inc (OH)
2860 Fisher Road
Columbus, OH 43204

Lab Code: 754502-1
Date Received: 05/29/26
Date Analyzed: 06/02/26
Date Reported: 06/02/26

Project: Fleet Library 26510080COL

Method: ASBESTOS BULK PLM, EPA 600 METHOD

Client ID / Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS Fibrous		Non-Fibrous		ASBESTOS %
2A 4483429	Ceiling Tile	Heterogeneous White Fibrous Loosely Bound	10% 75%	Cellulose Glass	5% 10%	Paint Foil	**None Detected**
2B 4483430	Ceiling Tile	Heterogeneous White Fibrous Loosely Bound	10% 75%	Cellulose Glass	5% 10%	Paint Foil	**None Detected**
3A 4483431	Sink Undercoating	Homogeneous Pink Non-Fibrous Bound	2%	Cellulose	80% 13%	Binder Calc Carb	**Chrysotile 5%**
3B 4483432	Sink Undercoating	Homogeneous Pink Non-Fibrous Bound	2%	Cellulose	80% 13%	Binder Calc Carb	**Chrysotile 5%**
4A 4483433	Carpet Adhesive	Homogeneous Tan Non-Fibrous Bound	2%	Cellulose	60% 38%	Mastic Calc Carb	**None Detected**
4B 4483434	Carpet Adhesive	Homogeneous Tan Non-Fibrous Bound	2%	Cellulose	60% 38%	Mastic Calc Carb	**None Detected**
5A 4483435	Caulk	Homogeneous Black Non-Fibrous Bound	<1%	Glass	100%	Caulk	**None Detected**

ASBESTOS BULK ANALYSIS
By: Polarized Light Microscopy

Client: CTL Engineering, Inc (OH)
2860 Fisher Road
Columbus, OH 43204

Lab Code: 754502-1
Date Received: 05/29/26
Date Analyzed: 06/02/26
Date Reported: 06/02/26

Project: Fleet Library 26510080COL

Method: ASBESTOS BULK PLM, EPA 600 METHOD

Client ID / Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS Fibrous		NON-ASBESTOS COMPONENTS Non-Fibrous		ASBESTOS %
5B 4483436	Caulk	Homogeneous Black Non-Fibrous Bound	2% 	Talc 	98% 	Caulk 	**None Detected**
6A 4483437	Ceramic Tile Mastic	Homogeneous Tan Non-Fibrous Bound	2% 	Cellulose 	60% 38%	Mastic Calc Carb	**None Detected**
6B 4483438	Ceramic Tile Mastic	Homogeneous Tan Non-Fibrous Bound	2% 	Cellulose 	60% 38%	Mastic Calc Carb	**None Detected**
7A 4483439	Floor Tile	Homogeneous Light-brown Non-Fibrous Bound	2% 	Cellulose 	60% 38%	Vinyl Calc Carb	**None Detected**
7A (2) 4491318	Mastic	Homogeneous Tan Non-Fibrous Bound	2% 	Cellulose 	60% 38%	Mastic Calc Carb	**None Detected**
7B 4483440	Floor Tile	Homogeneous Light-brown Non-Fibrous Bound	2% 	Cellulose 	60% 38%	Vinyl Calc Carb	**None Detected**
7B (2) 4491326	Mastic	Homogeneous Tan Non-Fibrous Bound	2% 	Cellulose 	60% 38%	Mastic Calc Carb	**None Detected**

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ASBESTOS BULK ANALYSIS
By: Polarized Light Microscopy

Client: CTL Engineering, Inc (OH)
2860 Fisher Road
Columbus, OH 43204

Lab Code: 754502-1
Date Received: 05/29/26
Date Analyzed: 06/02/26
Date Reported: 06/02/26

Project: Fleet Library 26510080COL

Method: ASBESTOS BULK PLM, EPA 600 METHOD

Client ID / Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS Fibrous		Non-Fibrous		ASBESTOS %
8A 4483441	Cove Base	Homogeneous Brown Non-Fibrous Bound			100%	Vinyl	**None Detected**
8A (2) 4491344	Mastic	Homogeneous Tan Non-Fibrous Bound	2%	Cellulose	60% 38%	Mastic Calc Carb	**None Detected**
8B 4483442	Cove Base	Homogeneous Brown Non-Fibrous Bound			100%	Vinyl	**None Detected**
8B (2) 4491345	Mastic	Homogeneous Tan Non-Fibrous Bound	2%	Cellulose	60% 38%	Mastic Calc Carb	**None Detected**
9A 4483443	Caulk	Homogeneous Brown Non-Fibrous Bound	<1%	Talc	100%	Caulk	**None Detected**
9B 4483444	Caulk	Homogeneous Brown Non-Fibrous Bound	<1%	Talc	100%	Caulk	**None Detected**
10A 4483445	Floor Tile	Homogeneous Beige/black Non-Fibrous Bound	2%	Cellulose	60% 36%	Vinyl Calc Carb	**Chrysotile 2%**

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ASBESTOS BULK ANALYSIS
By: Polarized Light Microscopy

Client: CTL Engineering, Inc (OH)
2860 Fisher Road
Columbus, OH 43204

Lab Code: 754502-1
Date Received: 05/29/26
Date Analyzed: 06/02/26
Date Reported: 06/02/26

Project: Fleet Library 26510080COL

Method: ASBESTOS BULK PLM, EPA 600 METHOD

Client ID / Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS Fibrous		NON-ASBESTOS COMPONENTS Non-Fibrous		ASBESTOS %
10A (2) 4491507	Mastic	Homogeneous Tan Non-Fibrous Bound	2% 	Cellulose 	60% 38% 	Mastic Calc Carb 	**None Detected**
10B 4483446	Floor Tile	Homogeneous Beige/black Non-Fibrous Bound	2% 	Cellulose 	60% 36% 	Vinyl Calc Carb 	**Chrysotile 2%**
10B (2) 4491508	Mastic	Homogeneous Tan Non-Fibrous Bound	2% 	Cellulose 	60% 38% 	Mastic Calc Carb 	**None Detected**
11A Layer A 4483447	Joint Compound	Heterogeneous White Non-Fibrous Bound	2% 	Cellulose 	3% 80% 15% 	Paint Calc Carb Binder 	**None Detected**
Layer B 4483447	Drywall	Heterogeneous Brown Non-Fibrous Bound	10% 	Cellulose 	90% 	Gypsum 	**None Detected**
				Composite (Composited Layers: A, B)			**0%**
11B Layer A 4483448	Joint Compound	Heterogeneous White Non-Fibrous Bound	2% 	Cellulose 	3% 80% 15% 	Paint Calc Carb Binder 	**None Detected**
Layer B 4483448	Drywall	Heterogeneous Brown Non-Fibrous Bound	10% 	Cellulose 	90% 	Gypsum 	**None Detected**
				Composite (Composited Layers: A, B)			**0%**

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ASBESTOS BULK ANALYSIS
By: Polarized Light Microscopy

Client: CTL Engineering, Inc (OH)
2860 Fisher Road
Columbus, OH 43204

Lab Code: 754502-1
Date Received: 05/29/26
Date Analyzed: 06/02/26
Date Reported: 06/02/26

Project: Fleet Library 26510080COL

Method: ASBESTOS BULK PLM, EPA 600 METHOD

Client ID / Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS Fibrous		Non-Fibrous		ASBESTOS %
12A 4483449	Fireproofing	Homogeneous Gray Fibrous Loosely Bound	90%	Glass	10%	Binder	**None Detected**
12B 4483450	Fireproofing	Homogeneous Gray Fibrous Loosely Bound	90%	Glass	10%	Binder	**None Detected**
12C 4483451	Fireproofing	Homogeneous Gray Fibrous Loosely Bound	90%	Glass	10%	Binder	**None Detected**
12D 4483452	Fireproofing	Homogeneous Gray Fibrous Loosely Bound	90%	Glass	10%	Binder	**None Detected**
12E 4483453	Fireproofing	Homogeneous Gray Fibrous Loosely Bound	90%	Glass	10%	Binder	**None Detected**
13A Layer A 4483454	Roofing Caulk	Heterogeneous Brown/cream Non-Fibrous Bound	<1%	Talc	100%	Caulk	**None Detected**
Layer B 4483454	Roofing Caulk	Homogeneous Gray Non-Fibrous Bound	<1%	Talc	100%	Caulk	**None Detected**

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ASBESTOS BULK ANALYSIS
By: Polarized Light Microscopy

Client: CTL Engineering, Inc (OH)
2860 Fisher Road
Columbus, OH 43204

Lab Code: 754502-1
Date Received: 05/29/26
Date Analyzed: 06/02/26
Date Reported: 06/02/26

Project: Fleet Library 26510080COL

Method: ASBESTOS BULK PLM, EPA 600 METHOD

Client ID / Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS Fibrous		Non-Fibrous		ASBESTOS %
13B Layer A 4483455	Roofing Caulk	Heterogeneous Brown/cream Non-Fibrous Bound	<1%	Talc	100%	Caulk	**None Detected**
Layer B 4483455	Roofing Caulk	Homogeneous Gray Non-Fibrous Bound	<1%	Talc	100%	Caulk	**None Detected**
14A Layer A 4483456	Roofing	Heterogeneous Black Fibrous Bound	20%	Glass	80%	Tar	**None Detected**
Layer B 4483456	Roofing	Homogeneous Brownish-black Fibrous Bound	65%	Cellulose	15%	Tar	**Chrysotile 20%**
Layer C 4483456	Paper W/ Yellow Foam	Heterogeneous Black Fibrous Bound	15%	Cellulose	85%	Foam	**None Detected**
Layer D 4483456	Fibrous Material	Homogeneous Brown Fibrous Loose	85%	Cellulose	15%	Perlite	**None Detected**

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ASBESTOS BULK ANALYSIS
By: Polarized Light Microscopy

Client: CTL Engineering, Inc (OH)
2860 Fisher Road
Columbus, OH 43204

Lab Code: 754502-1
Date Received: 05/29/26
Date Analyzed: 06/02/26
Date Reported: 06/02/26

Project: Fleet Library 26510080COL

Method: ASBESTOS BULK PLM, EPA 600 METHOD

Client ID / Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS Fibrous		Non-Fibrous		ASBESTOS %
14B Layer A 4483457	Roofing	Heterogeneous Black Fibrous Bound	20%	Glass	80%	Tar	**None Detected**
Layer B 4483457	Roofing	Heterogeneous Brownish-black Fibrous Bound	50%	Cellulose	50%	Tar	**None Detected**
Layer C 4483457	Paper W/ Yellow Foam	Heterogeneous Black Fibrous Bound	15%	Cellulose	85%	Foam	**None Detected**
Layer D 4483457	Fibrous Material	Homogeneous Brown Fibrous Loose	85%	Cellulose	15%	Perlite	**None Detected**
15A Layer A 4483458	Roofing Paint	Homogeneous Silver Non-Fibrous Bound	3%	Talc	95%	Paint	**Chrysotile 2%**
Layer B 4483458	Roofing Tar Material	Homogeneous Black Non-Fibrous Bound	2%	Cellulose	91%	Tar	**Chrysotile 7%**

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ASBESTOS BULK ANALYSIS
By: Polarized Light Microscopy

Client: CTL Engineering, Inc (OH)
2860 Fisher Road
Columbus, OH 43204

Lab Code: 754502-1
Date Received: 05/29/26
Date Analyzed: 06/02/26
Date Reported: 06/02/26

Project: Fleet Library 26510080COL

Method: ASBESTOS BULK PLM, EPA 600 METHOD

Client ID / Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS Fibrous		Non-Fibrous		ASBESTOS %
15B Layer A 4483459	Roofing Paint	Homogeneous Silver Non-Fibrous Bound	3%	Talc	95%	Paint	Chrysotile 2%
Layer B 4483459	Roofing Tar Material	Homogeneous Black Non-Fibrous Bound	2%	Cellulose	91%	Tar	Chrysotile 7%

LEGEND:

Non-Anth = Non-Asbestiform Anthophyllite
Non-Trem = Non-Asbestiform Tremolite
Calc Carb = Calcium Carbonate

METHOD: EPA 600 / R93 / 116 and EPA 40 CFR Appendix E to Subpart E of Part 763

REPORTING LIMIT: 1% by calibrated visual estimation

REGULATORY LIMIT: 1%

Due to the limitations of the EPA 600 / R93 / 116 method, nonfriable organically bound materials (NOBs) such as vinyl floor tiles can be difficult to analyze via polarized light microscopy (PLM). EPA recommends that all NOBs analyzed by PLM, and found not to contain asbestos, be further analyzed by Transmission Electron Microscopy (TEM). Please note that PLM analysis of dust and soil samples for asbestos is not covered under NVLAP accreditation. Estimated measurement of uncertainty is available on request.

Eurofins Built Environment Testing East, LLC makes no warranty representation regarding the accuracy of client submitted information in preparing and presenting analytical results. Interpretation of the analytical results is the sole responsibility of the client. This report relates only to the samples tested or analyzed and may not be reproduced, except in full, without written approval by Eurofins Built Environment Testing East, LLC. Samples were received in acceptable condition unless otherwise noted. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. Government.

Information provided by customer includes customer sample ID and sample description.

Shilpa Ladekar
Analyst

DATA QA: Samantha Webster
6/2/2026

APPROVED BY: Kamila Reichert,
Laboratory Director

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RES Job #: 754502

SUBMITTED BY		INVOICE TO		CONTACT INFORMATION		SERIES
Company:	CTL Engineering, Inc (OH)	Company:	CTL Engineering, Inc (OH)	Contact:	Matt McClelland	-1 PLM Standard 3
Address:	2860 Fisher Road	Address:	2860 Fisher Road	Phone:	(614) 824-3527	
	Columbus, OH 43204		Columbus, OH 43204	Fax:		
				Cell:		
Project Number and/or P.O. #:	None Given	Project Zip Code:		Final Data Deliverable Email Address:		
Project Description/Location:	Fleet Library 26510080COL			mmcclelland@ctleng.com (+ 1 ADDNL. CONTACTS)		

ASBESTOS LABORATORY

PLM / PCM / TEM / NYS DTL RUSH PRIORITY STANDARD

CHEMISTRY LABORATORY

Dust RUSH PRIORITY STANDARD

Metals RUSH PRIORITY STANDARD *PRIOR NOTICE REQUIRED FOR SAME DAY TAT

Organics* SAME DAY RUSH PRIORITY STANDARD

MICROBIOLOGY LABORATORY

Viable Analysis** PRIORITY STANDARD

**TAT DEPENDENT ON SPEED OF MICROBIAL GROWTH

Medical Device Analysis RUSH STANDARD

Mold Analysis RUSH PRIORITY STANDARD

****Turnaround times establish a laboratory priority, subject to laboratory volume and are not guaranteed. Additional fees apply for afterhours, weekends and holidays.****

Special Instructions:

VALID MATRIX CODES

Air = A	Bulk = B
Dust = D	Food = F
Paint = P	Soil = S
Surface = SU	Swab = SW
Tape = T	Wipe = W
Drinking Water = DW	
Waste Water = WW	
ASTM E1792 approved wipe media only	

LAB NOTES

OH

Client Sample ID Number (Sample ID's must be unique)	REQUESTED ANALYSIS: PLM - PLM Short Report (EPA/600/R-93/116)	TEM	PCM	NYS	DUST	METALS	ORGANICS	VIABLES	MEDICAL	MOLD	ICO	Sample Volume (L) / Area	Sample Temperature (°C)	Length(or Aliquots) x Width(or Area/Aliquot)	Matrix Code	# of Containers	Date Collected mm/dd/yy	Time Collected hh:mm	Laboratory Analysis Instructions
	ASBESTOS				CHEMISTRY			MICROBIOLOGY			ICO								
1 1A	X														B				
2 1B	X														B				
3 1C	X														B				
4 2A	X														B				
5 2B	X														B				
6 3A	X														B				
7 3B	X														B				
8 4A	X														B				
9 4B	X														B				
10 5A	X														B				
11 5B	X														B				
12 6A	X														B				
13 6B	X														B				

Eurofins Built Environment Testing East, LLC establishes a unique Lab Sample ID, for each sample, by preceding each unique Client Sample ID with the laboratory RES Job Number.

Eurofins Built Environment Testing East, LLC will analyze incoming samples based on information received and will not be responsible for errors or omissions in calculations resulting from the inaccuracy of original data. By signing, client/company representative agrees that submission of the following samples for requested analysis as indicated on this Chain of Custody shall consitute an analytical services agreement with payment terms of NET30. Failure to comply with payment terms may result in a 18% APR finance charge.

Relinquished By:		Date/Time: 05/29/2026 9:50:45	Sample Condition: Acceptable
Received By:	John Foernzler	Date/Time: 05/29/2026 12:23:40	Carrier: Fed-Ex

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RES Job #: **754502**

Submitted By: **CTL Engineering, Inc (OH)**

		REQUESTED ANALYSIS											VALID MATRIX CODES							LAB NOTES
													Air = A			Bulk = B				OH
													Dust = D			Food = F				
													Paint = P			Soil = S				
													Surface = SU			Swab = SW				
													Tape = T			Wipe = W				
													Drinking Water = DW							
													Waste Water = WW							
													ASTM E1792 approved wipe media only							
		PLM - PLM Short Report (EPA/600/R-93/116)	TEM	PCM	NYS	DUST	METALS	ORGANICS	VIABLES	MEDICAL	MOLD	ICO	Sample Volume (L) / Area	Sample Temperature (°C)	Length(or Aliquots) x Width(or Area/Aliquot)	Matrix Code	# of Containers	Date Collected mm/dd/yy	Time Collected hh:mm	Laboratory Analysis Instructions
	Client Sample ID Number (Sample ID's must be unique)	ASBESTOS				CHEMISTRY			MICROBIOLOGY			ICO								
14	7A	X														B				
15	7B	X														B				
16	8A	X														B				
17	8B	X														B				
18	9A	X														B				
19	9B	X														B				
20	10A	X														B				
21	10B	X														B				
22	11A	X														B				
23	11B	X														B				
24	12A	X														B				
25	12B	X														B				
26	12C	X														B				
27	12D	X														B				
28	12E	X														B				
29	13A	X														B				
30	13B	X														B				
31	14A	X														B				
32	14B	X														B				
33	15A	X														B				
34	15B	X														B				

754502

34

eurofins CEI

CHAIN OF CUSTODY

730 SE Maynard Road, Cary, NC 27511
Tel: 866-481-1412 Fax: 919-481-1442

LAB USE ONLY:
CEI Lab Code:
CEI Lab I.D. Range:

COMPANY INFORMATION	PROJECT INFORMATION
CEI CLIENT #:	Job Contact: Matt McClelland
Company: CTL Engineering	Email / Tel: Same
Address: 2860 Fisher Rd	Project Name: Fleet Library
Columbus, OH 43204	Project ID#: 265108COL
Email: MMcclelland@ctleng.com	PO #:
Tel: 614-824-3527 Fax:	STATE SAMPLES COLLECTED IN: OH

IF TAT IS NOT MARKED STANDARD 3 DAY TAT APPLIES.

ASBESTOS	METHOD	TURN AROUND TIME					
		4 HR	8 HR	1 DAY	2 DAY	3 DAY	5 DAY
PLM BULK	EPA 600	☐	☐	☐	☐	☒	☐
PLM POINT COUNT (400)	EPA 600	☐	☐	☐	☐	☐	☐
PLM POINT COUNT (1000)	EPA 600	☐	☐	☐	☐	☐	☐
PLM GRAV w POINT COUNT	EPA 600		☐	☐	☐	☐	☐
PLM BULK	CARB 435		☐	☐	☐	☐	☐
PCM AIR	NIOSH 7400	☐	☐	☐	☐	☐	☐
TEM AIR	EPA AHERA	☐	☐	☐	☐	☐	☐
TEM AIR	NIOSH 7402	☐	☐	☐	☐	☐	☐
TEM AIR (PCME)	ISO 10312	☐	☐	☐	☐	☐	☐
TEM AIR	ASTM 6281-15	☐	☐	☐	☐	☐	☐
TEM BULK	CHATFIELD		☐	☐	☐	☐	☐
TEM DUST WIPE	ASTM D6480-05 (2010)	☐	☐	☐	☐	☐	☐
TEM DUST MICROVAC	ASTM D5755-09 (2014	☐	☐	☐	☐	☐	☐
TEM SOIL	ASTM D7521-16			☐	☐	☐	☐
TEM VERMICULITE	CINCINNATI METHOD			☐	☐	☐	☐
TEM QUALITTATIVE	IN-HOUSE METHOD		☐	☐	☐	☐	☐
OTHER		☐	☐	☐	☐	☐	☐

REMARKS / SPECIAL INSTRUCTIONS:

☑ Accept Samples
☐ Reject Samples

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	5-28-26/15:30	AT	5/29/26 9:50

Samples will be disposed of 30 days after analysis

8723 6107 0946

chrome-extension://oemmndcbldboiebfnladdacbdfmadadm/https://cdnmedia.eurofins.com/eurofins-us/media/1385047/2018-asb-bulk-coc.pdf

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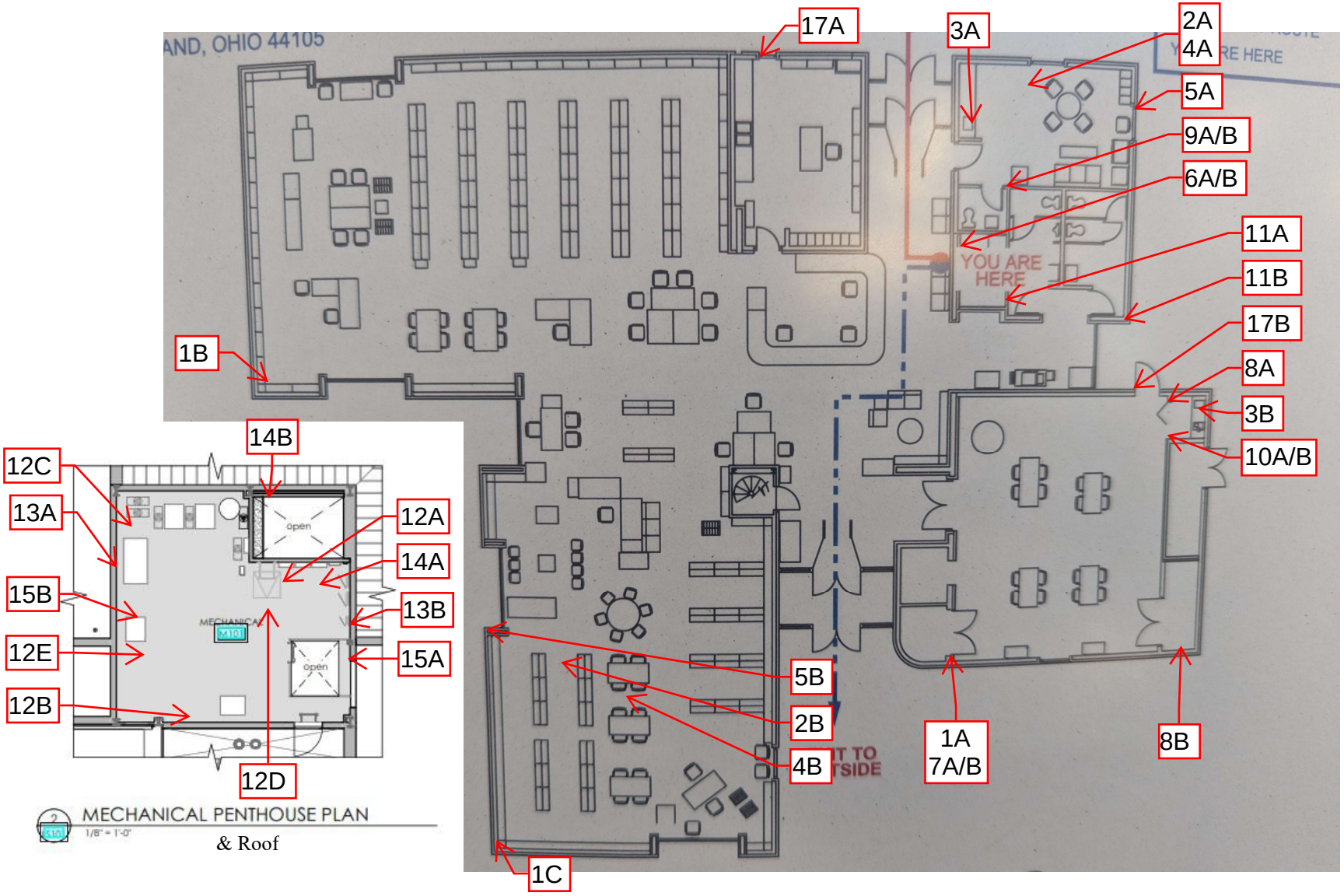
~~MOLD / MATERIALS IDENTIFICATION~~ ASBESTOS SAMPLING FORM

CEI

COMPANY CONTACT INFORMATION	
Company: CTL Engineering	Job Contact:
Project Name: Fleet Library	
Project ID #: 26510080 COC	Tel:

FIELD ID #	SAMPLE LOCATION	~~AREA (SQ. INCH)~~ PLM	VOLUME (LITRES)
1A/B/C	drywall/joint compound	X	
2A/B	2x2 ceiling tile	↓	
3A/B	gray sink undercoat		
4A/B	tan carpet adhesive		
5A/B	black window/door caulk		
6A/B	tan ceramic tile Mastic		
7A/B	12" tan mottled floor tile/mastic		
8A/B	brown cove base/mastic		
9A/B	brown exterior caulk		
10A/B	12" beige/black floor tile/mastic		
11A/B	brown drywall/joint compound		
12A/B/C/D/E	gray fireproofing		
13A/B	gray roof caulk		
14A/B	built-up roofing		
15A/B	silver roof paint		

APPENDIX C - SAMPLE LOCATION PLANS



ASBESTOS SAMPLE LOCATION PLAN GTL ENGINEERING LLC	DATE 6/8/26	**Cleveland Public Library – Fleet Branch** **7724 Broadway Avenue** **Cleveland, Ohio 44105**
	SCALE ---	
DRAWN BY Dept. 51	Figure No. 1	Project No. 26510080COL

APPENDIX D - XRF READINGS

XRF Readings

7224 Broadway Ave., Cleveland, OH

Date	Reading	Mode	Pass/Fail Standard	Pb Concentration	Test Location	Component	Substrate	Color	Condition
28-May-26	T1	Standardization	PASS						
28-May-26	T2	Lead Paint Fixed-Time	Negative	0.00	Calibration				
28-May-26	T3	Lead Paint Fixed-Time	Positive (Pass)	1.04 (+/-0.06)	Calibration				
28-May-26	1	Lead Paint Fixed-Time	Negative	0.0	Computer lab	Wall	Drywall	Blue	Intact
28-May-26	2	Lead Paint Fixed-Time	Negative	0.0	Computer lab	Wall	Drywall	Blue	Intact
28-May-26	3	Lead Paint Fixed-Time	Negative	0.1	Computer lab	Wall	Drywall	Blue	Intact
28-May-26	4	Lead Paint Fixed-Time	Negative	0.0	Computer lab	Ceiling	Drywall	White	Intact
28-May-26	5	Lead Paint Fixed-Time	Negative	0.0	Reading room/stacks	Wall	Drywall	Blue	Intact
28-May-26	6	Lead Paint Fixed-Time	Negative	0.0	Reading room/stacks	Wall	Drywall	Blue	Intact
28-May-26	7	Lead Paint Fixed-Time	Negative	0.0	Reading room/stacks	Wall	Drywall	Blue	Intact
28-May-26	8	Lead Paint Fixed-Time	Negative	0.1	Reading room/stacks	Ceiling	Drywall	White	Intact
28-May-26	9	Lead Paint Fixed-Time	Negative	0.0	Meeting room	Wall	Drywall	Blue	Intact
28-May-26	10	Lead Paint Fixed-Time	Negative	0.0	Meeting room	Wall	Drywall	Blue	Intact
28-May-26	11	Lead Paint Fixed-Time	Negative	0.0	Meeting room	Wall	Drywall	Blue	Intact
28-May-26	12	Lead Paint Fixed-Time	Negative	0.0	Meeting room	Ceiling	Drywall	White	Intact
28-May-26	13	Lead Paint Fixed-Time	Negative	0.0	IT closet	Wall	Drywall	White	Intact
28-May-26	14	Lead Paint Fixed-Time	Negative	0.0	IT closet	Ceiling	Drywall	White	Intact
28-May-26	15	Lead Paint Fixed-Time	Negative	0.1	Men's restroom	Wall	Drywall	White	Intact
28-May-26	16	Lead Paint Fixed-Time	Negative	0.0	Men's restroom	Wall	Drywall	White	Intact
28-May-26	17	Lead Paint Fixed-Time	Negative	0.0	Men's restroom	Ceiling	Drywall	White	Intact
28-May-26	18	Lead Paint Fixed-Time	Negative	0.0	Women's restroom	Wall	Drywall	White	Intact
28-May-26	19	Lead Paint Fixed-Time	Negative	0.2	Women's restroom	Wall	Drywall	White	Intact
28-May-26	20	Lead Paint Fixed-Time	Negative	0.0	Women's restroom	Ceiling	Drywall	White	Intact
28-May-26	21	Lead Paint Fixed-Time	Negative	0.0	Employee office	Wall	Drywall	Blue	Intact
28-May-26	22	Lead Paint Fixed-Time	Negative	0.0	Employee office	Wall	Drywall	Blue	Intact

XRF Readings

7224 Broadway Ave., Cleveland, OH

Date	Reading	Mode	Pass/Fail Standard	Pb Concentration	Test Location	Component	Substrate	Color	Condition
28-May-26	23	Lead Paint Fixed-Time	Negative	0.0	Employee office	Wall	Drywall	Blue	Intact
28-May-26	24	Lead Paint Fixed-Time	Negative	0.0	Employee bathroom	Wall	Drywall	White	Intact
28-May-26	25	Lead Paint Fixed-Time	Negative	0.0	Employee bathroom	Wall	Drywall	White	Intact
28-May-26	26	Lead Paint Fixed-Time	Negative	0.0	Employee bathroom	Ceiling	Drywall	White	Intact
28-May-26	27	Lead Paint Fixed-Time	Negative	0.1	Employee lounge	Wall	Drywall	Green	Intact
28-May-26	28	Lead Paint Fixed-Time	Negative	0.0	Employee lounge	Wall	Drywall	Green	Intact
28-May-26	29	Lead Paint Fixed-Time	Negative	0.0	Employee lounge	Wall	Drywall	Green	Intact
28-May-26	30	Lead Paint Fixed-Time	Negative	0.1	Mechanical PH	Wall	Concrete	White	Intact
28-May-26	31	Lead Paint Fixed-Time	Negative	0.0	Mechanical PH	Wall	Concrete	White	Intact
28-May-26	T4	Lead Paint Fixed-Time	Negative	0.00	Calibration				
28-May-26	T5	Lead Paint Fixed-Time	Positive (Pass)	1.04 (+/-0.06)	Calibration				

APPENDIX E - CERTIFICATIONS

Environmental Protection Agency

EPA.Ohio.gov

Mike DeWine, *Governor* Jim Tressel, *Lt. Governor* John Logue, *Director*

9/5/2025

Matthew McClelland
10600 State Route 303
Windham, OH 44288

RE: Evaluation Specialist
Certification Number: ES34598
Expiration Date: 9/16/2026

Dear Matthew McClelland:

This letter and enclosed certification card approves your request to be certified as an asbestos Evaluation Specialist. You must present your card upon request at any project site while performing duties. Copies of cards are not acceptable as proof of certification.

This certification may be revoked by the Director of the Ohio Environmental Protection Agency (EPA) for violation of any of the requirements of 3745-22 or 3745-20 of the Ohio Administrative Code.

If you have any questions, please contact the Asbestos Program at 614-644-0226 or by email at asbestoslicensing@epa.ohio.gov.

Sincerely,

Brandon M. Schwendeman
Brandon Schwendeman
Manager, Business Operations Support Section
Ohio EPA - Division of Air Pollution Control



50 West Town Street • Suite 700 • P.O. Box 1049 • Columbus, OH 43216-1049
epa.ohio.gov • (614) 644-3020 • (614) 644-3184 (fax)

Ohio | Department of Health

Mike DeWine, Governor
Jon Husted, Lt.Governor

Bruce Vanderhoff, MD, MBA, Director

June 04, 2024

Matt W McClelland
5806 Snowdrop Avenue
Galloway OH 43119

RE: Lead Risk Assessor
License Number: LA007913
Expiration Date: 06/13/2026

Dear Matt W McClelland:

This letter and enclosed license approves your request to be licensed as a Lead Risk Assessor. You must present your license upon request at any project site while performing duties. A copy of your license is not acceptable as proof of licensure.

Please be aware of the rules and regulations governing your discipline for Ohio. If you choose to renew this license, you must take an Ohio approved refresher course appropriate for the discipline within your current two year licensure period. Renewal applications must be submitted prior to the expiration of your current license to avoid additional reinstatement fees. Please visit our website at www.odh.ohio.gov for information.

This license may be revoked by the Director of Health for violation of any of the requirements of 3701-32 of the Ohio Administrative Code.

If you have any questions, please call the Ohio Department of Health, Lead Poisoning Prevention Program at (614) 466-1450.

Sincerely,

Shamus Estep
Program Administrator
Bureau of Environmental Health and Radiation Protection



Certificate of Training

Has completed the Heuresis Corp. training materials presented on the topic of Instrument Operator Training, Pb200i, with regards to the materials licensed by the Commonwealth of Massachusetts and the Nuclear Regulatory Commission.

HEURESIS
CORPORATION

Instrument Operator Training
Heuresis Corporation, Pb200i

I confirm that the above named individual has received the training listed on this certificate.

Adam Robison
Name

August 21st, 2020
Date

Senior Director of Sales
Title



I certify that I have received the stated training and understand the content presented. I understand that I can follow up this training with questions from Heuresis Corporation.

Matt McClelland
Name

August 8th, 2020
Date

BULLETIN #01

BULLETIN TO THE PROJECT MANUAL AND DRAWINGS

1. This Bulletin supplements and amends the Contract Documents for this Project, Cleveland Public Library – Fleet Branch Renovation and Expansion, including previously issued Addenda and Bulletins. Attach this Bulletin to the Construction Documents. This Bulletin consists of written information as follows. Should contents of this Bulletin conflict with the previously issued Drawings and Specifications the requirements of this Bulletin shall govern.

PROJECT MANUAL AND DRAWING REVISION CONVENTION

2. Drawing Revisions: Additions, modifications, and deletions are identified with a clouded revision symbol. Revisions are identified with a corresponding number (delta 'X') signifying the change made to each sheet.
3. Project Manual Revisions: Each section that has been added, modified, or deleted is identified with the revision name and date, i.e. Bulletin #01 - 08.20.2026. Modifications to previously issued specifications are marked as follows:
   a. Additions are identified with **text that is underlined and bolded**.
   b. Deletions are identified with ~~**text that is struck through and bolded**~~.

ITEM NO. 1 – REVISIONS TO PROJECT MANUAL

1. Added sections:
   a. 03 31 24 – Environmental Assessment Information
   b. 07 11 13 – Bituminous Dampproofing
   c. Appendix 03, Hazardous Materials Survey to Project Manual
2. Removed sections:
   a. 07 13 00 – Sheet Waterproofing
   b. 11 11 36 – Vehicle Charging Equipment
   c. 14 92 23 – Hoists
3. Revised sections:
   a. 08 43 13 – Aluminum Framed Entrances and Storefronts
   b. 22 07 19 – Plumbing Piping Insulation
   c. 22 13 19 – Sanitary Waste Piping Specialties
   d. 22 40 00 – Plumbing Fixtures.pdf

ITEM NO. 2 - REVISIONS TO DRAWINGS

1.2 CIVIL

1. C200 - CIVIL DEMO PLAN

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a. Revised notes regarding existing underground waterline

2. C300 - CIVIL SITE PLAN
   a. Revised monument sign orientation and keynotes
   b. Removed hydronic snowmelt system
   c. Removed electric vehicle charger and revised keynotes
3. C400 - CIVIL GRADING PLAN
   a. Relocated waterline and indicated new route
4. C500 - CIVIL UTILITY PLAN
   a. Relocated waterline and indicated new route
5. C602 - CIVIL CONSTRUCTION DETAIL
   a. Added sheet

1.3 LANDSCAPE

1. L200 – PAVER DETAILS & LAYOUT PLAN
   a. Included permeable paver detail

1.4 ARCHITECTURAL

1. A001 – TYPICAL WALL TYPES & DETAILS
   a. Added wall type S6d
2. A101 – FLOOR PLANS
   a. Added wall type S6d
   b. Revised (2) wall types between Rooms 117/119 and 122/123
3. A102 – FIRST FLOOR DIMENSION PLAN
   a. Added wall type S6d
   b. Located (2) walls between Rooms 117/119 and 122/123
4. A103 – ROOF PLAN & DETAILS
   a. Revised detail 6/A103
   b. Located hoist baseplate, details provided by Structural
5. A602 - WALL SECTIONS
   a. Revised section to note sill flashing
6. A603 - WALL SECTIONS
   a. Revised section to note sill flashing
7. A610 - ENLARGED SECTION DETAILS
   a. Revised section to note sill flashing
8. A901 – DOOR & GATE SCHEDULE & DETAILS
   a. Revised stile size of door types C & D

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b. Updated Head detail H4 in coordination with Structural Drawings

9. A910 – FINISH SELECTIONS & DETAILS
    a. Revised Finish type ACT-2
10. A911 – FINISH PLANS
    a. Revised floor finish in Vestibule 101
    b. Removed area of depressed slab in Vestibule 101

1.5 STRUCTURAL

1. S101 – FOUNDATION PLAN
    a. Removed area of depressed slab in Vestibule 101
2. S102 – LOW ROOF FRAMING PLANS
    a. Added post design & details
    b. Updated Plan Notes
    c. Sized interior hoist beam

1.6 MECHANICAL

1. MS101 – SITE MECHANICAL
    a. Removed Sheet.
2. M100 – UNDERGROUND MECHANICAL PIPING
    a. Removed all underground snow melt piping from plan tagged as HHWS-SM & HHWR-SM.
    b. Removed snow melt manifolds tagged as SMM-1 and SMM-2.
3. M101B – FIRST FLOOR MECHANICAL PIPING
    a. Removed all snow melt piping from plan tagged as HHWS-SM & HHWR-SM.
    b. Removed snow melt manifolds tagged as SMM-1 and SMM-2.
4. M102A – PENTHOUSE & ROOF MECHANICAL PIPING
    a. Removed HHWP-5 from project.
    b. Removed snow melt piping on plan tagged as HHWS-SM & HHWR-SM.
    c. Removed HX-1 from project.
    d. Removed ADSP-2 from project.
    e. Removed EXT-2 from project.
    f. Removed snow melt controller panel.
5. M102B – PENTHOUSE & ROOF MECHANICAL PIPING
    a. Removed HHWP-5 from project.
    b. Removed snow melt piping on plan tagged as HHWS-SM & HHWR-SM.
    c. Removed HX-1 from project.
    d. Removed ADSP-2 from project.
    e. Removed EXT-2 from project.

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f. Removed snow melt controller panel.

6. M601 – MECHANICAL SCHEDULES
   a. Removed HHWP-5 from project.
   b. Removed HX-1 from project.
   c. Removed associated heat exchanger remarks along with heat exchanger schedule.
7. M602 – MECHANICAL SCHEDULES
   a. Removed EXT-2 from project.
   b. Removed ADSP-2 from project.
   c. Removed Remark 4 from “Air Separator Schedule”.
8. M603 – MECHANICAL DIAGRAMS
   a. Removed hydronic snow melt system components and piping from “Hydronic One-Line Diagram”.
9. M701 – MECHANICAL CONTROLS
   a. Removed diagram and sequence 9, for “Hydronic Snow Melt Controls”
10. M702 – MECHANICAL CONTROLS
    a. Removed points, modified controls sequences.
11. M703 – MECHANICAL CONTROLS
    a. Removed points.
12. M704 – MECHANICAL CONTROLS
    a. Removed “SNOW MELT” section of control point list.
    b. Removed points.

1.7 PLUMBING

1. PD101 – FIRST FLOOR PLUMBING DEMO
   a. Added sheet note 4 which called for underground domestic cold-water line to be demolished where it is shown on plan.
2. P100 – UNDERGROUND PLUMBING
   a. Added new 2” domestic cold-water piping to plan, reflecting new domestic cold water site line.
   b. Added sheet note 4.
3. P101 – FIRST FLOOR PLUMBING
   a. Shifted domestic cold water line plan east, to accommodate new site entry point.
   b. Removed sheet note 4.
4. P102 – PENTHOUSE PLUMBING
   a. Added sheet note 4 calling for drain line from reduced pressure backflow preventor.
   b. Changed backflow preventor size on plan to match connected piping.
   c. Shifted floor penetration location for 2” domestic cold-water line inlet into penthouse.

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5. P601 – PLUMBING SCHEDULES
    a. Changed WC-1 model to a higher flow model (1.25 gpf to 1.6 gpf).

1.8 ELECTRICAL

1. ES101 – SITE ELECTRICAL
    a. EVSE has been removed, but its associated pathway, including the pull string, pull box and panelboard breaker, shall remain the same as per design.
    b. Added sheet note 7.
2. E102 – PENTHOUSE AND ROOF POWER NEW PLAN
    a. Removed the disconnect switch and its associated circuit for the hoist.
    b. Removed the j-box and its associated circuit for the sidewalk snowmelt controller.
    c. Removed the disconnect switch and its associated circuit for the HHWP-5.
    d. Sheet notes 7, 13 and 15 are no longer in use.
3. E601 – ELECTRICAL ONELINE DIAGRAM
    a. Removed the disconnect switch for the hoist.
    b. Sheet note 6 is no longer in use.
    c. Removed (1) type from the feeder schedule.
4. E602 – ELECTRICAL SCHEDULES
    a. Removed circuits LNP1B:1,3, LND:22 and C:6,14,16,18 but their breakers shall remain the same per the design.

1.9 TECHNOLOGY

1. T101 – FIRST FLOOR TECHNOLOGY NEW PLAN
    a. Removed (1) exterior camera.

END OF BULLETIN

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