

CLATSOP COUNTY CIRCUIT COURT SECURITY IMPROVEMENT

Astoria, OR
for
Clatsop County

Project Manual

28 JUNE 2022

Bid Set

SERA Project Number
2101028



**ARCHITECTURE
URBAN DESIGN + PLANNING
INTERIOR DESIGN**

**338 NW 5TH AVE
PORTLAND, OREGON 97209
P. 503.445.7372
F. 503.445.7395
SERADESIGN.COM**

Architect of Record

- A. SERA Design and Architecture, Inc.
Architect: George D. Hager, Jr.
Address: 600 SW 10th Avenue, Suite 500
City: Portland, Oregon
Tel: 503-445-7372
- B. Project Manager: Steven Ehlbeck
Email: StevenE@seradesign.com



MEP-F:

- A. Cundiff Engineering, Inc. (CEI)
Plumbing Engineer:
Mech. Engineer: Christopher Boyd
Elect. Engineer: Pedro Alzaga
Address: 7007 SW Cardinal Ln,
City: Portland, Oregon
Tel: 503-521-7260
- B. Project Manager: Christopher Boyd
Email: ChrisB@cundiffmep.com



EXPIRES: 12/31/2023

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NOT USED

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PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Summary of the Work.
- B. Owner's occupancy.
- C. Contractor's use of site and general limitations.
- D. Definitions used throughout the Specification and Drawings.
- E. Specification formats and conventions.

1.02 PROJECT

- A. Project Name: Clatsop County Circuit Court Security Improvements
- B. Architect's Name and Address:
 - 1. SERA Design and Architecture, Inc.
Architect of Record: George D. Hager, Jr.
600 SW 10th Avenue, Suite 500
Portland, Oregon 97205
- C. The Project consists of the alteration of the existing Clatsop County Circuit Courthouse in Astoria, Oregon. The scope occurs mostly in the basement level of the building, where an existing storage room at the south of the building is converted to a security screening room where visitors can go through a security review prior to entry. Another storage space at the north side of the building is renovated into holding rooms for use of the Sheriff's office when escorting person in their custody to court. Other minor scopes include modernizing various elevator equipment, replacing an existing floor drain at the south entry stair, replacing the sashes in exterior windows on the main level, and installing bullet-resistant glazing at the level two reception area..

1.03 DESCRIPTION OF ALTERATIONS WORK

- A. Scope of demolition and removal work is indicated on drawings and specified in Section 02 41 00.
- B. Scope of alterations work is indicated on drawings.

1.04 OWNER FURNISHED ITEMS AND WORK

- A. Items noted OFOI (Owner Furnished Owner Installed) will be furnished and installed by Owner before Substantial Completion.
 - 1. Furnishings.
 - 2. Magnetometer.
 - 3. Security cameras, including all wiring. Limited conduit and rough-in is required by contractor, see drawings for further information.
- B. Items noted OFCI (Owner Furnished Contractor Installed) will be furnished to the Contractor for installation. The Contractor shall provide necessary components and their connection required for items to function properly as intended, including but not limited to, power, exhaust, ventilation, dust emission and collection.
 - 1. Verify OFCI items prior to start of construction.

1.05 OWNER OCCUPANCY

- A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.
- B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

1.06 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.

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

B. Arrange use of site and premises to allow:

1. Owner occupancy.

2. Work by Others.

3. Work by Owner.

4. Use of site by the public.

C. No Smoking Policy: Smoking is prohibited on Project Site.

D. 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.

E. Utility Outages and Shutdown:

1. Limit disruption of utility services to hours the building is unoccupied.

2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.

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

1.07 WORK SEQUENCE

A. Construct Work in stages during the construction period:

1. Stage 1: Scope of Work excluding elevator upgrades for cab finishes and equipment upgrades.

2. Stage 2: Elevator upgrades for cab finishes and equipment upgrades.

B. Coordinate construction schedule and operations with Owner.

1.08 DELEGATED DESIGN REQUIREMENTS

A. General requirements for Delegated Design components are specified in Section 01 35 73.

B. Specific design requirements are specified in Sections of Division 02 through 50.

1.09 DEFINITIONS

A. Basic Contract definitions are included in the General Conditions.

1. Basic Contract Definitions: Contract Documents, Work, Project, Drawings, Specifications, Project Manual, Owner, Contractor, Subcontractor, Architect, Contract Time, Day, Substantial Completion, Contract Sum (or GMP), Change Order.

2. Basic contract definitions that are not defined in Division 01 - General Requirements shall have the same meaning as defined in Section 00 72 00 - General Conditions.

3. Where these definitions conflict with the Design-Builders prime contract with Owner, the prime contract shall govern.

B. "AHJ": Authority Having Jurisdiction is defined as "An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure."

C. "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.

- D. "Day": If not defined in the General Conditions to the Contract, "Day" shall mean calendar day.
- E. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" have the same meaning as "directed."
- F. "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."
- G. "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.
- H. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, connection to building systems, and similar operations.
- I. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations, complete and ready for the intended use.
- J. "Provide": Furnish and install, complete and ready for the intended use.
- K. "Project Site": Space available for performing construction activities. The extent of Project site is shown in Drawings and may or may not be identical with the description of the land on which Project is to be built.
- L. "Work": Project material "furnished" and "installed" complete and ready for the intended use.

1.10 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the CSI/CSC's MasterFormat 50-Division numbering system.
- B. Sections in Division 01 govern the execution of the Work of all Sections in the Specifications and Drawings.
- C. 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. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
 - 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
 - 3. 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.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Contract modification procedures.
- C. Additional architectural service for extraordinary contract administration.
- D. Procedures for preparation and submittal of application for final payment.

1.02 DEFINITIONS

- A. Architectural Bulletin Form (AB Form): Architect's form issued by Architect indicating "Architect's Supplemental Instruction" or "Proposal Request" or "Construction Change Directive" or as a signature cover to Contractor initiated proposal.
 - 1. AB Form is included at the end of section.
- B. Architect's Supplemental Instruction (ASI): Minor change in Work directed by Architect.
- C. Proposal Request (PR): A formal request from Architect to Contractor for change in Contract Sum and Time required to perform a proposed change in Work. Proposal Request is not a directive to perform the proposed change.
- D. "Construction Change Directive" and "Change Order" have meanings defined in AIA Document A201.
- E. Additional Contract Administration Services: Architectural service to enforce Contract Documents resulting from Contractor's failure to comply with requirements or Contractor's request for accelerated procedures.

1.03 SCHEDULE OF VALUES

- A. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
- B. Forms filled out by hand will not be accepted.
- C. Submit a printed schedule on AIA Form G703 - Application and Certificate for Payment Continuation Sheet. Contractor's standard form or electronic media printout will be considered.
- D. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.
- 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.
- F. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.
- G. Revise schedule to list approved Change Orders, with each Application For Payment.
- H. See Article entitled "Applications for Progress Payments" for additional requirements.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: Submit at intervals stipulated in the Agreement.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- C. Forms filled out by hand will not be accepted.
- D. Present required information on electronic media printout.

- E. Form: AIA G702 Application and Certificate for Payment and AIA G703 - Continuation Sheet including continuation sheets when required.
- F. Changes in the work shall be initiated using the SERA Architectural Bulletin (AB) Form.
- G. Additional contract administration services is an additional architectural service and will be billed to the Owner who will then back-charge the Contractor .
- H. Execute certification by notarized signature of authorized officer.
- I. 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.
- J. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
- K. Submit electronically editable PDF copy of each Application for Payment.
- L. 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 32 16.
 3. Project Record Documents as specified in Section 01 78 00, for review by Owner which will be returned to the Contractor.
 - a. Alternative: Review Record Documents with Architect prior to submitting Application.
 4. Preliminary Closeout Documents when specified in Section 01 78 00.
- M. Materials stored off site and included in the schedule of values for monthly payment application are to be stored in a bonded and secure facility. Copies of bill of sale for materials and certificate of insurance for material with Owner named as an insured are to be included with the payment application.
- N. 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.

1.05 MODIFICATION PROCEDURES

- A. For minor changes not involving an adjustment to the Contract Price or Contract Time, Architect will issue instructions directly to Contractor.
- B. Architect will advise of minor changes in the Work not involving an adjustment to Contract Sum or Contract Time as authorized by the Conditions of the Contract by issuing supplemental instructions on Architectural Bulletin Form (AB Form).
- C. Construction Change Directive: Architect may issue an AB Form, signed by Owner, instructing Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
 2. Promptly execute the change.
- D. Proposal Request: Architect may issue an AB Form which includes a detailed description of a proposed change with supplementary or revised Drawings and Specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and

the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 15 days.

- E. Contractor -initiated Requests for Change:
 - 1. Contractor may propose a change by submitting a Request for Change to Architect, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Section 01 60 00. Contractor initiated Request for Change will be processed in one of the following methods:
 - a. Architect may reject Contractor proposal or may return it for modification.
 - b. Architect may attach Contractor proposal to SERA AB Form, complete the AB Form appropriately, and distribute it for signatures.
 - c. Architect may accept Contractor 's form if document has a place for signatures, sign it and distribute to Owner for signature.
 - 2. Accepted requests for change: Obtain written acceptance from the Architect or Structural Engineer of Record for Contractor -initiated Requests for Change from that indicated in the contract documents.
 - 3. Bear costs for Contractor -initiated Requests for Change.
 - 4. Pay engineering fees for Structural Engineer of Record's time to check the adequacy of such changes.
- F. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
 - 1. For pre-determined unit prices and quantities, the amount shall be based on the fixed unit prices.
- G. Substantiation and Computation of Costs: Provide complete itemized cost information with substantiating backup for each item for evaluation as follows:
 - 1. Quantities of products, labor, and equipment.
 - 2. Taxes, insurance, and bonds.
 - 3. Overhead and profit on products and labor only. Overhead and profit is limited as follows:
 - a. As indicated in the Agreement
 - 4. Justification for any change in Contract Time.
 - 5. Credit for deletions from Contract, similarly documented.
 - 6. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.
- H. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- I. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.
- J. Promptly enter changes in Project Record Documents.

1.06 EXTRAORDINARY CONTRACT ADMINISTRATION SERVICE

- A. Owner-Architect Agreement identifies certain additional services for which Architect may receive additional compensation. Some of these services may result out of actions or non-actions by Contractor ; these include, but are not limited to:
 - 1. Design services for modification resulting from substitution proposed by Contractor.
 - 2. Review of submittals after the first re-submittal.
 - 3. Review or response to unnecessary or frivolous RFI.
 - 4. Second notification and review of non-compliant work.
 - 5. Design services to correct or incorporate non-compliant work.

6. Design or engineering specified as Contractor 's responsibility; for example, for delegated design components or for performance-specified work.
7. Performing administrative work specified as Contractor 's responsibility when Contractor refuses to perform after notification.
8. Performing administrative work specified as Contractor 's responsibility when requested to expedite the Work.
9. Providing extra construction administration services after the specified date of Substantial Completion or the specified date of Final Completion when delay is not caused by Owner.
10. Re-inspection for Substantial Completion or Final Completion.
- B. Architect will issue Notice for Extraordinary Contract Administration Services to Owner and a copy to Contractor . Thereafter, Architect will record time and expense for each occurrence, or in the case of recurring occurrences, each type of occurrence.
 1. Architect will, at their discretion, invoice Owner monthly for additional services.
 2. Architect's fee schedule for additional services is included in Owner-Architect Agreement, and is available to Contractor upon request.
- C. Owner reserves the right to charge the cost of Architect's extraordinary contract administration service plus 10 percent administration cost to Contractor in an AB Form.

1.07 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.
 2. Affidavit that payrolls and bills have been satisfied.
 3. Consent of Surety to make Final Payment.
 4. Certificate evidencing that Builder's Risk insurance required after Substantial Completion will remain in force and a written statement that Contractor knows of no reason that insurance will not be renewed for the required period until Final Payment

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

(project) Architectural Bulletin



Project Name: Project Name
Project Number: #####
Initiated By: What Company
Client: Client
Contractor: GC Name

Bulletin No. ##
Date Issued ## Month Year
Client Contract #

Subject

The following instruction is hereby issued:

☐ **ARCHITECT'S SUPPLEMENTAL INSTRUCTION** (complete **PART A** only)

The Work shall be carried out in accordance with the following supplemental instructions issued in accordance with the Contract Documents without change in Contract Sum or Contract Time. Proceeding with the Work in accordance with these instructions indicates the Contractors acknowledgement that there will be no change in the Contract Sum or Contract Time.

☐ **PROPOSAL REQUEST** (complete **PART A** only)

Please submit an itemized quotation for changes to the Contract Sum and/or Contract Time incidental to the proposed modifications of the Contract Documents described below. **DO NOT PROCEED WITH WORK UNTIL RECEIVING FURTHER WRITTEN INSTRUCTION** This is not a change order, a construction change directive or a direction to proceed with the work described herein.

☐ **CONSTRUCTION CHANGE DIRECTIVE** (complete **PARTS A & B**)

You are hereby directed to make the following change(s) in this Contract. Track the costs of changes to the Contract as described in *proposed adjustments* (Part B) below.

PART A: DESCRIPTION OF WORK

- x.1 (DISPOSITION)** (Description – describe work scope in this space – text to be Title Case and not bold. Column to left, i.e. “disposition” to denote type of change using on the following works (or iterations), “**ADD**”, “**DELETE**”, “**CLARIFY**”, or “**CHANGE**”. Disposition text to be ALL CAPS and **bold**.)
- x.2 (DISPOSITION)** (Description – describe work scope in this space – text to be Title Case and not bold. Column to left, i.e. “disposition” to denote type of change using on the following works (or iterations), “**ADD**”, “**DELETE**”, “**CLARIFY**”, or “**CHANGE**”. Disposition text to be ALL CAPS and **bold**.)

ATTACHMENTS:

Issued by: SERA (entity) (SERA employee)

PART B: PROPOSED ADJUSTMENTS

1. The proposed basis of adjustment to the Contract Sum or Guaranteed Maximum Price is:

- ☐ Unit Price of \$ per
☐ Lump Sum (increase) (decrease) of \$
☐ As provided in Subparagraph 7.3.3 of AIA Document A201 2007 Edition
☐ As follows:

2. The Contract Time is proposed to:

- ☐ Remain unchanged

SERA Design and Architecture, Inc.

☐ Be adjusted with an (increase) (decrease) of days

When signed by the Client and Architect, and received by the Contractor, this document becomes effective IMMEDIATELY as a Construction Change Directive (CCD), and the Contractor shall proceed with the change(s) described above.

Signature by the Contractor indicates agreement with the proposed adjustments in Contract Sum and Contract Time set forth in this Directive.

ARCHITECT	CLIENT/CLIENT'S REP	CONTRACTOR
SERA Architects, Inc. 600 SW 10 th Avenue, Suite 500 Portland, Oregon 97205	(Company name) (Company address)	(Company name) (Company address)
Signed:	Signed:	Signed:
Date:	Date:	Date:

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cash allowances.
- B. Contingency allowance.
- C. Inspecting and testing allowances.
- D. Payment and modification procedures relating to allowances.

1.02 RELATED REQUIREMENTS

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

1.03 CASH ALLOWANCES

- A. Costs Included in Cash Allowances: Cost of product to Contractor or subcontractor, less applicable trade discounts, less cost of delivery to site , less applicable taxes .
- B. Costs Not Included in Cash Allowances: Product delivery to site and handling at the site, including unloading, uncrating, and storage; protection of products from elements and from damage; and labor for installation and finishing.
- C. Architect Responsibilities:
 - 1. Consult with Contractor for consideration and selection of products, suppliers , and installers.
 - 2. Select products in consultation with Owner and transmit decision to Contractor.
 - 3. Prepare Change Order.
- D. Contractor Responsibilities:
 - 1. Assist Architect in selection of products, suppliers , and installers.
 - 2. Obtain proposals from suppliers and installers and offer recommendations.
 - 3. On notification of which products have been selected, execute purchase agreement with designated supplier and installer.
 - 4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
 - 5. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.
- E. Differences in costs will be adjusted by Change Order.

1.04 CONTINGENCY ALLOWANCE

- A. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit will be included in Change Orders authorizing expenditure of funds from this Contingency Allowance.
- B. Funds will be drawn from the Contingency Allowance only by Change Order.
- C. At closeout of Contract, funds remaining in Contingency Allowance will be credited to Owner by Change Order.

1.05 INSPECTING AND TESTING ALLOWANCES

- A. Costs Included in Inspecting and Testing Allowances: Cost of engaging an inspecting or testing agency; execution of inspecting and tests; and reporting results.
- B. Costs Not Included in the Inspecting and Testing Allowances:
 - 1. Costs of incidental labor and facilities required to assist inspecting or testing agency.
 - 2. Costs of testing services used by Contractor separate from Contract Document requirements.

3. Costs of retesting upon failure of previous tests as determined by Architect.
- C. Payment Procedures:
 1. Submit one copy of the inspecting or testing firm's invoice with next application for payment.
 2. Pay invoice on approval by Architect.
- D. Differences in cost will be adjusted by Change Order.

1.06 ALLOWANCES SCHEDULE

- A. Section 14 24 00 - Hydraulic Elevators: Include the stipulated sum of \$15,000.00 for purchase and delivery of elevator modernization of interior cab finishes and lighting.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

PART 1 GENERAL

1.01 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.

1.02 COSTS INCLUDED

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

1.03 UNIT QUANTITIES SPECIFIED

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

1.04 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 Architect.
- C. Assist by providing necessary equipment, workers, and survey personnel as required.
- D. Measurement Devices:
 - 1. Weigh Scales: Inspected, tested and certified by the applicable state Weights and Measures department within the past year.
 - 2. Platform Scales: Of sufficient size and capacity to accommodate the conveying vehicle.
 - 3. Metering Devices: Inspected, tested and certified by the applicable state department within the past year.
- E. Measurement by Weight: Concrete reinforcing steel, rolled or formed steel or other metal shapes will be measured by handbook weights. Welded assemblies will be measured by handbook or scale weight.
- F. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.
- G. Measurement by Area: Measured by square dimension using mean length and width or radius.
- H. Linear Measurement: Measured by linear dimension, at the item centerline or mean chord.
- I. 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.
- J. Perform surveys required to determine quantities, including control surveys to establish measurement reference lines. Notify Architect prior to starting work.
- K. Contractor's Engineer Responsibilities: Sign surveyor's field notes or keep duplicate field notes, calculate and certify quantities for payment purposes.

1.05 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.

1.06 DEFECT ASSESSMENT

- A. Replace Work, or portions of the Work, not complying with specified requirements.
- B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct 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 Architect.
 - 2. The defective Work will be partially repaired to the instructions of the Architect, and the unit price will be adjusted to a new unit price at the discretion of Architect.
- C. 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.
- D. The individual specification sections may modify these options or may identify a specific formula or percentage price reduction.
- E. The authority of Architect to assess the defect and identify payment adjustment is final.

1.07 SCHEDULE OF UNIT PRICES

- A. Item: wood window sash replacement; Section 08 03 53.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Schedule of Alternates.
- B. Procedures for Alternates.

1.02 DEFINITIONS

- A. Alternate: An amount proposed by Bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.
- B. Deferred Alternate: An Alternate that may be accepted by Owner after execution of Agreement.
 - 1. Deferred Time Limit: Unless stated otherwise in Bidding Requirements or Contracting Requirements or description of a specific Alternate, Alternates may be accepted up to 60 days after Bids are due.

1.03 PROCEDURE

- A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.

1.04 ACCEPTANCE OF ALTERNATES

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected or deferred at Owner's option. Accepted alternates will be identified in the Owner-Contractor Agreement or an amendment there to.
- B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.05 SCHEDULE OF ALTERNATES

- A. Alternate No. 1 - South Entry Drain - Concrete Stair Removal and Replacement:
 - 1. Base Scope: At the South entry stairs, demolish existing concrete landing and existing floor drain. Install new linear drain and new concrete lower landing.
 - 2. Alternate Description: Add scope to remove portion of existing exterior concrete stair run and upper stair landing. Install a trench drain at the upper landing, install piping to connect new trench drain to new linear drain included in base scope.
 - 3. A maximum of one alternate between Alternate No. 1 and Alternate No. 2 will be selected by owner for construction. Contractor to provide line-item cost for Alternates No. 1 and No. 2 to be selected by Owner.

B. Alternate No. [2] - [South Entry Drain - Remote Catch Basin Connection]:

1. Base Scope: At the South entry stairs, demolish existing concrete landing and existing floor drain. Install new linear drain and new concrete lower landing.
2. Alternate Description: Add scope to remove portion of existing exterior concrete stair run and upper stair landing. Install a trench drain at the upper landing, install piping to connect new trench drain to new linear drain included in base scope.
3. A maximum of one alternate between Alternate No. 1 and Alternate No. 2 will be selected by owner for construction. Contractor to provide line-item cost for Alternates No. 1 and No. 2 to be selected by Owner.

C. Alternate No. 3 - Main Level Door Hardware:

1. Alternate Description: Add scope to include changing door hardware for door 100 (double doors serving as the North entry to the main level). Hardware is revised to exit-only egress hardware. See section 08 71 00 for additional information.

D. Alternate No. 4 - Replace Existing Bullet-Resistant Glass:

1. Alternate Description: Add scope to replace existing bullet-resistant glass at main level courtroom and judges chambers. Existing glass is installed in metal-framed interior storm windows. Intent of alternate is to replace glass while re-using the existing storm-window frames. Basis of design is level 3 bullet resistance for glass. Contractor shall confirm compatibility of glass with existing frame size and verify desired bullet-resistance level with Owner and prior to purchase of glass product.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes procedure for coordinating and submitting Request for Interpretation (RFI).

1.02 DEFINITIONS

- A. RFI: Request from Contractor to Architect seeking interpretation or clarification of the Contract Documents.

1.03 RFI PROCEDURE

- A. Review Contract Documents and Project Site in a thorough and timely manner so Architect will have sufficient time to respond to RFI prior to execution of subject construction.
 - 1. Claim for additional Time or Cost when RFI is answered within time limit specified in this Section will be rejected.
- B. Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.
 - 1. RFIs shall originate with Contractor . RFIs submitted by entities other than Contractor will be returned with no response.
 - 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor 's work or work of subcontractors.
- C. When possible, request interpretation at next Progress Meeting. Record Architect's response in meeting minutes.
 - 1. When response is not given during meeting, submit RFI in approved format.

1.04 SUBMITTALS

- A. RFI Form: Electronic form furnished by Architect, numbered and signed by Contractor .
 - 1. Number each page of attachments with RFI number in lower right corner.
 - 2. Attachments shall be electronic files in Portable Document Format (PDF) format.
- B. RFI Content: Include detailed, legible description of item needing interpretation and the following:
 - 1. Project name and number.
 - 2. Date.
 - 3. Name of Contractor.
 - 4. Name of Architect.
 - 5. RFI number, numbered sequentially. Add revision numbers as decimal and digit.
 - 6. RFI subject title, less than five words
 - 7. Initiator of question
 - 8. Specification Section number and title and related paragraphs, as appropriate.
 - 9. Drawing number and detail references, as appropriate.
 - 10. Field dimensions and conditions, as appropriate.
 - 11. Contractor 's suggested solution(s). If Contractor 's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state anticipated impact in the RFI.
 - 12. Contractor 's signature.
 - 13. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
 - a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.
 - 14. Single discipline per RFI: Architectural, Civil, Structural, Mechanical or Electrical

15. Space for reply on same page, if possible.
- C. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use form from Procore. Include the following:
1. Project name.
 2. Name and address of Contractor .
 3. Name and address of Architect.
 4. RFI number including RFIs that were dropped and not submitted.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Architect's response was received.
 8. Identification of related Minor Change in the Work, Instrument of Change, Construction Change Directive, or Proposal Request, as appropriate.

1.05 ARCHITECT'S ACTION

- A. Architect will review each RFI, determine action required, and return it. Allow 7 days in total for Architect and Consultant response for each RFI..
1. Architect's goal will be to return RFI as quickly as possible. However, quick response is not guaranteed.
 2. The following RFIs are defined as frivolous and will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for information already indicated in the Contract Documents.
 - d. Requests for information derived from activities assigned to Contractor in the Contract Documents.
 - e. Requests for approval of adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or RFIs with numerous errors.
 - h. Questions relating to construction means, methods, techniques, sequences, procedures or safety precautions. (These are Contractor 's responsibility exclusively.)
 - i. Questions relating to construction schedule, coordination between trades, or division of work among subcontractors. (These are also Contractor 's responsibility exclusively.)
 3. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
 4. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Contract Modification Procedures.
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
 - b. Do not proceed with this work until Change Order is executed.
- B. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within 5 days if Contractor disagrees with response.
- C. Frivolous RFI's: An RFI can be considered frivolous if the requested information is clearly shown in the Contract Documents. In addition, an RFI submitted confirming information already in the contract documents, confirming information previously provided by Architect, or requesting confirmation to questions previously answered are also considered frivolous. Frivolous RFI's may constitute a claim from the Architect or Engineer against the Contractor . Compensation will be assessed to Contractor in accordance with Section 01 20 00 - Price and Payment Procedures.

1.06 QUALITY ASSURANCE

- A. Contractor shall strive to keep the number of RFIs to a minimum.
 - 1. Prior to submitting RFI, carefully study Contract Documents to assure that requested information is not already available. RFIs that request information available in the Contract Documents will be considered frivolous.
- B. RFI is not a substitute for Shop Drawing. When multiple RFIs are submitted for related work, Architect may require a Shop Drawing.
- C. RFI submitted by Fax is not acceptable.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

REQUEST FOR INTERPRETATION

[THIS SPACE IS
INTENDED FOR
CONTRACTOR LOGO
AND CONTACT
INFO]

[Project Name]

[Project #]

RFI #

Subcontractor RFI #

RFI Title

Issued on

Requested return date

Requested by

Description

(with proposed solution as applicable):

SAMPLE FORM

The Work shall be carried out in accordance with the following supplemental instructions issued in accordance with the Contract Documents without change in Contract Sum or Contract Time. Proceeding with the Work in accordance with these instructions indicates your acknowledgment that there will be no change in the Contract Sum or Contract Time.

Detail/Drawing #

Specification Section(s)

Attachments

[Client]

[Client Contract #]

Critical to Schedule: ☐ Yes ☐ No

Response:

Architect Review

Date

Consultant Review

Date

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Communication with Architect.
- B. Project coordination.
- C. Preconstruction meeting.
- D. Progress meetings.
- E. Construction progress schedule.
- F. Progress photographs.
- G. Coordination drawings.
- H. Submittals for review, information, and project closeout.
- I. Number of copies of submittals.
- J. Submittal control report and submittal procedures, including the following:
 - 1. Proposed products list.
 - 2. Product data.
 - 3. Shop drawings.
 - 4. Samples.
 - 5. Design data.
 - 6. Test reports.
 - 7. Certificates.
 - 8. Manufacturer's instructions.
 - 9. Manufacturer's field reports.

1.02 SUBMITTALS

- A. Pre-Construction Meeting Submittals: Bonds, insurance, schedule of values, project personnel directory, subcontractor and supplier list, and other lists; specified in other Sections.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
 - 1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.
- C. Minutes of meetings required in this Section.
- D. Coordinated Ceiling Drawings: \
 - 1. Architect will review, stamp and return a digital copy with comments within 14 days after receipt. Procedure requirements for Shop Drawings apply.
 - 2. Architect's review is for compliance with design intent and does not relieve Contractor of coordination and performance requirements.
 - 3. Electronically distribute reviewed drawings to appropriate entities.
- E. Submittal Control Report:
 - 1. Prepare and maintain a separate submittal log to monitor submittals required by the contract documents. Show:
 - a. Work item number corresponding to the specification section and construction schedule.

- b. Contractor, subcontractor, sub-subcontractor or supplier responsible for each work item.
 - c. Narrative description of the work item.
 - d. Number of days required for preparation of the submittal.
 - e. Date submittal due.
 - f. Number of days allowed for approval.
 - g. Date approval due.
 - h. Number of days required to fabricate and deliver item to the Contractor .
 - i. Date of delivery.
 - j. Date item required to be installed, corresponding to the construction schedule.
2. Distribution:
- a. Distribution copies of reviewed schedule to: Architect and Consultants.
 - b. Instruct recipients to report any inability to comply and provide detailed explanation with suggested remedies.
- F. Submit digital copies of photographs to Owner on approved media (CD, DVD) with project record documents. Catalog and index files in chronological sequence; include table of contents in editable format such as Microsoft Word.

1.03 PROJECT COORDINATION

- A. Coordinate construction operations specified in different Sections to ensure efficient and orderly installation of each part of the Work. Coordinate portions of work that depend on each other for proper installation, connection, and operation.
- B. The written agreement, drawings, specifications and any addenda comprise the contract for this project. They shall be treated as one entity, equally, without priority. Items, elements, fixtures, systems and equipment shown shall be furnished and installed even though typically shown elsewhere. Therefore it is the responsibility of the Contractor to read and comprehend these documents in order to complete the work. If a Contractor chooses to not thoroughly review the entire set of contract documents, they do so at their own risk and agree to furnish and install items noted above at no additional cost or delay to the Owner.
- C. In the event of an inconsistency in the Drawings or between the Drawings and the Specifications, unless otherwise ordered in writing by the Architect, the Contractor shall provide the greater quantity and/or better quality of work.
- D. A reasonable amount of time is being provided for bidders to determine if there are, in fact, any such inconsistencies. If inconsistencies are found, request an appropriate clarification by Addendum. Inconsistencies not reported during the time of bid shall be deemed finally acceptable by the Contractor and will not result in extensions of time or additional compensation.
- E. Coordinate scheduling, submittals, and Work of 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.
- F. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, operating equipment.
- G. Coordinate, design, permit, and construct necessary means for interfacing components required to accomplish all phases of the Work including code required permitting of engineered worker and public life safety and property safety elements such as barricades, shoring, and other protective temporary measures (see Section 01 35 73 - Delegated Design

Procedures).

- H. Coordinate space requirements, supports, and installation of mechanical and electrical Work indicated diagrammatically on Drawings. Follow routing shown 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.
- I. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
 - 1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
 - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - b. Indicate required installation sequences.
 - c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

1.04 DIGITAL COMMUNICATION

- A. Communication to Architect: High speed internet based digital, except as required for submittals.
 - 1. Telephone communication is acceptable for initial or simple issues.
 - 2. Follow up telephone communication in writing.
- B. Construction Office Equipment:
 - 1. High speed internet connection equipment and service.
 - a. Email Attachment Capacity: Not less than 10 megabytes.
 - 2. Computer with internet connection and project management software:
 - a. Microsoft Office 2010 or newer with Word, Excel, and Outlook.
 - b. Bluebeam Revu 2016.5.2 or newer.
 - c. Project scheduling software.
 - 3. Scanner, not less than 150 dpi.
 - 4. Copy machine not less than 400 dpi with capability for 11 x17 and color.
 - 5. Telephone with conference call capability
 - 6. Digital camera, 3.5 megapixel minimum.
- C. Correspondence:
 - 1. Correspondence by FAX is not acceptable.
 - 2. Any information that is disseminated shall retain the original scale and aspect from the original as published by Architect.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

- A. Owner/Architect will schedule a meeting after Notice to Proceed.
- B. Attendance Required:
 - 1. Owner.
 - 2. Owner's Project Manager.

3. Architect.
4. Contractor.
- C. Agenda:
 1. Execution of Owner-Contractor Agreement.
 2. Submission of executed bonds and insurance certificates.
 3. Distribution of Contract Documents.
 4. Submission of complete list of Subcontractors, with contact information, list of Products, schedule of values, submittal schedule, and progress schedule with any critical path work sequencing and long lead time materials.
 5. Designation of personnel representing the parties to the Contract between Owner and Architect .
 6. Procedures and processing of field decisions, submittals, substitutions, RFI's, requests for applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 7. Construction site access: pick-up, delivery, and parking; temporary facilities and controls, security, safety, and restrictions.
 8. Scheduling activities of Testing Agent, Green Rater, and Commissioning Agent.
 9. Progress cleaning.
 10. Anticipated building service or system interruptions, and impact to building operations/occupants.
- D. Contractor shall record minutes and distribute copies electronically within four days after meeting to participants, with one (1) copy to Architect, Owner, participants, and those affected by decisions made.

3.02 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the Work at maximum weekly intervals.
 1. Architect may elect to attend by telephone conference call.
- B. Attendance Required:
 1. Contractor.
 2. Owner.
 3. Owner's Project Manager.
 4. Architect/Engineer, as appropriate to agenda topics for each meeting.
 - a. Architect shall attend in person or via conference call at Architect's discretion.
 5. Contractor's superintendent.
 6. Major Subcontractors and suppliers.
- C. Agenda:
 1. Review minutes of previous meetings.
 2. Review of work progress.
 3. Field observations, problems, and decisions.
 4. Identification of problems that impede, or will impede, planned progress.
 5. Review of submittals schedule and status, RFI's and status, and proposal request/change orders and status.
 6. Review of off-site fabrication and delivery schedules.
 7. Maintenance of progress schedule.
 8. Corrective measures to regain projected schedules.
 9. Planned progress during succeeding work period.
 10. Coordination of projected progress.
 11. Maintenance of quality and work standards.
 12. Effect of proposed changes on progress schedule and coordination.
 13. Other business relating to work.

- D. Contractor shall record minutes and distribute copies electronically within four days after meeting to participants, with one (1) copy to Architect, Owner, participants, and those affected by decisions made.

3.03 PREINSTALLATION MEETING

- A. When required in individual specification sections, convene preinstallation meeting at Project site prior to commencing work of specific section.
- B. Work undertaken or completed without convening a preinstallation meeting shall be subject to removal, inspection, testing, observation, etc at the Architect's discretion without additional compensation to Contractor in time or money. Work required as a result of removal, inspection, testing, observation, etc., even though determined to be satisfactory, shall be provided without additional compensation to the Contractor in time or money.
- C. Require attendance of parties directly affecting, or affected by, Work of specific section including the Architect, Owner, Design Engineer, manufacturer (representative and technical support) and key personnel of the installation team.
- D. Notify Architect seven (7) days in advance of meeting date.
- E. Prepare agenda and preside at meeting:
 - 1. Review conditions of installation, preparation and installation procedures.
 - 2. Review coordination with related work.
- F. Record minutes and distribute copies electronically within four (4) days after meeting to participants, with one (1) copy to Architect, Owner, and those affected by decisions made.

3.04 CONSTRUCTION PROGRESS SCHEDULE - SEE SECTION 01 32 16

3.05 PROGRESS PHOTOGRAPHS

- A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.
- B. Maintain one set of all photographs at project site for reference; same copies as submitted, identified as such.
- C. Photography Type: Digital; electronic files.
 - 1. No less than 3.5 mega pixel.
- D. Provide photographs of site and construction throughout progress of work produced by an experienced photographer, acceptable to Architect.
- E. Views:
 - 1. Take one (1) site photograph from same direction indicating relative progress of the Work.
 - 2. Consult with Architect for instructions on views required.
 - 3. Provide factual presentation.
 - 4. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.
- F. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
 - 1. Delivery Medium: Via email.
 - 2. File Naming: Include project identification, date and time of view, and view identification.
 - 3. Point of View Sketch: Include digital copy of point of view sketch with each electronic submittal; include point of view identification in each photo file name.
 - 4. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.
 - 5. Hard Copy: Printed hardcopy (grayscale) of PDF file and point of view sketch.

3.06 COORDINATION DRAWINGS

- A. General: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
 - 1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
 - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - b. Indicate required installation sequences.
 - c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
 - 2. Sheet Size: At least 8-1/2 by 11 inches but no larger than Project Drawings.
 - 3. Media: CADD electronic "dwg" files unless other media is approved by Architect.
- B. Coordinated Ceiling Drawings:
 - 1. Content and View: Two views, concealed conditions and visually exposed conditions, shown as reflected plans. Indicate actual size of components at scale sufficient to show no interference and adequate space for installation and maintenance of each component.
 - a. Concealed Conditions View: Including, but not limited to: mechanical systems (plumbing, ductwork, HVAC Equipment, piping, controls, fire protection systems, etc.); electrical systems (wiring, raceway, conduit, cable trays, controls, fire and life safety systems, lighting, alarm devices, etc.); structural elements (beams, girders, etc); acoustical systems, ceiling equipment supports.
 - b. Exposed Conditions View: Including, but not limited to: mechanical; electrical; structural elements as noted above; acoustical systems; lights – pendants, surface and recessed; exit signage; directional signage; conduit; grilles; diffusers; damper actuators; sprinkler heads/type, speaker locations, access panels with sizes indicated, smoke detectors and alarm devices, and any other item or element that will be seen when looking at the ceiling.
 - 2. Coordinate space requirements, supports, and installation of mechanical and electrical Work indicated diagrammatically on Drawings. Follow routing shown 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.
 - 3. Congested Areas: Provide more detailed plan and either vertical sections or 3-dimensional model.
 - 4. Show the following in different colors for each system: structure, HVAC, plumbing, piping, electrical, fire protection, other work.
 - 5. Distribute Coordinated Ceiling Drawings among affected entities for review. Resolve conflicts and incorporate corrections into drawings prior to submitting to Architect.
 - a. Work that is not included in Coordinated Ceiling Drawings shall be coordinated and installed without conflicts or defects, and without change in Time or Cost.

3.07 SUBMITTAL SCHEDULE

- A. Submit to Architect for review a schedule for submittals in tabular format.
 - 1. Submit at the same time as the preliminary schedule specified in Section - 01 32 16 - Construction Progress 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.

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.

3.08 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
 1. Product data.
 2. Shop drawings.
 3. Samples for selection.
 4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
- C. Contractor to verify actual material used meets all specification requirements.
- D. Samples will be reviewed for aesthetic, color, or finish selection.
- E. 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.

3.09 SUBMITTALS FOR INFORMATION

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

3.10 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
 1. Project record documents.
 2. Operation and maintenance data.
 3. Warranties.
 4. Bonds.
 5. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

3.11 NUMBER OF COPIES OF SUBMITTALS

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

- B. Extra Copies at Project Closeout: See Section 01 78 00.
- C. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
 - 1. After review, produce duplicates.
 - 2. Retained samples will not be returned to Contractor unless specifically so stated.

3.12 SUBMITTAL PROCEDURES

- A. General Requirements:
 - 1. Use a separate transmittal for each item.
 - 2. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
 - 3. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
 - a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
 - 4. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
 - 5. Schedule submittals to expedite the Project, and coordinate submission of related items.
 - 6. 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.
 - 7. Submittals not requested will be recognized, and will be returned "Not Reviewed",
- B. Product Data Procedures:
 - 1. Submit only information required by individual specification sections.
 - a. Provide edited submittal with specified information required indicated in a manner facilitating reference ease.
 - 2. Collect required information into a single submittal.
 - 3. Submit concurrently with related shop drawing submittal when applicable.
 - 4. Do not submit (Material) Safety Data Sheets for materials or products.
- C. Shop Drawing Procedures:
 - 1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
 - 2. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- D. Organize and submit complete information into separate submittals for each Specification Section listed in Table of Contents, electronically in editable PDF format, except as follows:
 - 1. One (1) consolidated Division submittal for Sections in the following Divisions:
 - a. Divisions 21, 22, and 23.
 - b. Divisions 26, 27 and 28.
 - c. Divisions 31, 32, and 33, except One (1) separate consolidated submittal for Landscaping is acceptable.
 - 2. Doors, door frames and door hardware: One (1) consolidated submittal.
 - 3. Exterior entrance, storefront, and curtain wall systems: One (1) consolidated submittal.
 - 4. Exceptions must be approved by Architect.
- E. Transmittal or Cover Sheet: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will discard submittals received from sources other than Contractor .
 - 1. Transmittal Form: Use CSI Form 12.1A.
 - 2. Incomplete transmittal form will be returned.

- F. Contractor 's Review: 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 requirements of the Work and Contract Documents.
 - 1. Review submittals prior to submission and provide stamp of approval signed or initialed by Contractor .
 - a. Contractor 's review indicates that Contractor has thoroughly reviewed the submittal and certifies that it is complete, correct, in compliance with the Contract Documents, and suitable for the Project.
 - b. Review represents that field measurements and field conditions have been considered and that the work submitted will perform as intended.
 - c. Review of Shop Drawing represents that required coordination with other work has been performed and is indicated on Shop Drawings.
 - 2. Architect will not review submittals that do not include Contractor 's signed review stamp, do not include required field conditions, or are not accurate.
 - 3. Include written description and graphic demarcation of deviations from requirements of Contract Documents.
 - 4. All work done prior to approval of submittals shall be at the Contractor's risk.
- G. Number submittals sequentially, followed by specification Section number.
 - 1. Revisions: Add "R-1" to submittal number; example "034-08 51 13 R-1".
- H. Schedule submittals to expedite the Project, and coordinate submission of related items. Send electronic submittals to Architect of Records business address, refer to Section 01 10 00. Coordinate submission of related items.
 - 1. Send one copy to Owner
- I. For each submittal for review, allow 14 days from time Architect receives electronic submittal.
 - 1. Allow additional 7 days for any one of the following submittals:
 - a. Major building components or consolidated submittals.
 - b. Review by Architect's consultant.
 - c. Review by Commissioning Agent.
 - d. Review by Owner.
- J. Clearly indicate all options, colors, accessories, data, etc, provided for this Project.

3.13 PRODUCT DATA

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. Provide product data whether specified or not specified in Section.
 - 2. If information that must be specially prepared for submittal because standard data are not suitable for use, submit as Shop Drawings, not as Product Data.
 - 3. Each submittal must show which product(s) and options are applicable to this Project.
- B. Include the following information, as applicable:
 - 1. Manufacturer's written recommendations.
 - 2. Manufacturer's product specifications.
 - 3. Manufacturer's installation instructions.
 - 4. Standard color charts.
 - 5. Manufacturer's catalog cuts.
 - 6. Wiring diagrams showing factory-installed wiring.
 - 7. Printed performance curves.
 - 8. Operational range diagrams.
 - 9. Mill reports.
 - 10. Standard product operation and maintenance manuals.

11. Compliance with specified referenced standards.
12. Testing by recognized testing agency.
13. Application of testing agency labels and seals.
14. Notation of coordination requirements.
- C. Mark submittals to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- D. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- E. Submit one (1) electronic copy in editable pdf form.
- F. Architect will return a reviewed electronic copy in PDF format.

3.14 SHOP DRAWING PROCEDURES

- A. Prepare accurate Project-specific information, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related Work. Do not base Shop Drawings on standard printed data or reproductions of the Contract Documents, unless use of Architect's Drawings is permitted.
 1. Provide Shop Drawings for work indicated in Sections and when needed to execute the Work.
- B. Electronic copy of Architect's Drawings (floor plans, site plan and ceiling plans, only) will not be provided, unless requested. It is incumbent upon the Contractor or Sub-contractor to execute the Electronic Media Agreement, located at the end of section, with the Architect prior to the release of any contract documents.
- C. Generic, non-project specific information submitted as shop drawings do not meet the requirements for shop drawings.
- D. Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 1. Dimensions.
 2. Three dimensional axonometric views of flashings, pans and sheet metal details.
 3. Identification of products.
 4. Fabrication and installation drawings.
 5. Roughing-in and setting diagrams.
 6. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 7. manufacturing instructions.
 8. Templates and patterns.
 9. Schedules.
 10. Design calculations.
 11. Compliance with specified standards.
 12. Notation of coordination requirements.
 13. Notation of dimensions established by field measurement.
 14. Relationship to adjoining construction clearly indicated.
 15. Seal and signature of professional engineer if specified.
 16. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
- E. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- F. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

3.15 SAMPLES

- A. Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
- B. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
- C. Identification: Attach label on unexposed side of Samples that includes the following:
 - 1. Generic description of Sample.
 - 2. Product name and name of manufacturer.
 - 3. Sample source.
 - 4. Number and title of appropriate Specification Section.
- D. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - 1. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - 2. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor .
- E. Samples for Initial Selection: Submit 2 manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
- F. 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.
 - 1. Submit three sets of Samples. Architect will retain one Sample set; remainder will be returned.
 - 2. Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 3. If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- G. Finishes, products and/or materials noted as custom, hand worked, etc shall be submitted to Architect for review and approval prior to fabrication/installation. Allow for minor revisions to sample in terms of finish, fabrication, installation and/or sequencing.
- H. Field Samples: Large size samples and assembled samples that shall be submitted at the Project Site are specified in individual Sections.

3.16 DELEGATED DESIGN SUBMITTALS

- A. Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- B. Submit for Architect's information.

1. Architect's review is limited to assessing conformance with design concept expressed in Contract Documents.

C. Refer to Section 01 35 73 - Delegated Design Procedures.

3.17 TEST REPORTS

- A. Submit for Architect's knowledge.
- B. Submit test reports for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

3.18 CERTIFICATES

- A. When specified in individual specification sections, submit certification by manufacturer, installation/application sub^{contractor}, or Contractor to Architect, in quantities specified for Product Data.
- B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Architect.

3.19 QUALIFICATION DATA

- A. When specified in individual specification sections or requested by Architect, submit qualifications for manufacturer, installer, or subcontractor.
- B. Data may include previous experience, list of previous similar projects, references, proof of training, and approval by manufacturer or warrantor.

3.20 SAMPLE WARRANTY

- A. When warranty is specified in a Section, submit sample of specified warranty with initial product submittal.
- B. Final warranty submittal is specified in Section 01 78 00 - Closeout Submittals.

3.21 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Architect for delivery to Owner in quantities specified for Product Data.
- B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

3.22 MANUFACTURER'S FIELD REPORTS

- A. Submit reports for Architect's benefit as contract administrator or for Owner.
- B. Submit report in duplicate within 30 days of observation to Architect for information.
- C. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

END OF SECTION

Electronic Media Agreement



Date Sent:

Project:

SERA Project #: Hereinafter "Project"

Firm:

Hereinafter "Recipient"

From:

SERA Architects, Inc. ("SERA") agrees to issue to Recipient plans, specifications and other information and data for Recipient's convenience and use to provide design or construction related services to the Project, in modifiable electronic media, including but not limited to AutoCAD files and Revit files, as listed below (collectively "Electronic Documents"), subject to the following conditions. Non-modifiable electronic media such as scans or Adobe pdf documents are not covered by, or subject to, the terms of this Electronic Document Release, and do not require execution of this Electronic Document Release.

1. SERA makes no representation with regard to the compatibility of the Electronic Documents with Recipient's software and hardware. Furthermore, Recipient acknowledges and accepts the risks associated with the transfer of Electronic Documents, including but not limited to software incompatibility, file degradation, and accidental or intentional deletion, modification or manipulation of electronic data by parties other than SERA.
2. The Electronic Documents are generated by SERA from the Construction Documents. Recipient acknowledges that Electronic Documents are not the Construction Documents, and that the information and data in the Construction Documents is what is intended for use in construction. The Electronic Documents are provided for Recipient's information only, for reference or modification to facilitate the design or construction of the Project. In the event of a conflict, not caused by SERA, between the information included in the Electronic Documents and the signed or sealed hard-copy Construction Documents issued by SERA, the signed or sealed hard-copy Construction Documents shall control.
3. Recipient acknowledges that the Electronic Documents were not developed to assist Recipient with Recipient's work. Accordingly, Recipient accepts that the form or format of the Electronic Documents may not be suitable for Recipient's intended use of the Electronic Documents. Recipient accepts the risk that the Electronic Documents may not be sufficiently or suitably formatted or otherwise ready for Recipient's use. Recipient accepts all risk associated with the form or format of the Electronic Documents or Recipient's modification of the Electronic Documents.
4. Prior to issuing the Electronic Documents, SERA may remove or obliterate its name, title block, professional seals and certifications from the Electronic Documents.
5. To the extent allowed by applicable law, Recipient shall indemnify, defend and hold harmless SERA and its subconsultants from and against any claim, damage, liability, or cost, including attorneys' fees or expert costs that may arise from Recipient's unauthorized use of or modification of the Electronic Documents.

6. Recipient will not distribute or release the Electronic Documents to any third-party, including Recipient's subconsultants or subcontractors, without such third party executing and delivering to SERA a signed counterpart of this Electronic Document Release. Recipient acknowledges that SERA requires that each party that receives SERA's Electronic Documents shall execute a similar Electronic Document Release for the benefit of SERA. To the extent allowed by applicable law, Recipient shall indemnify, defend and hold harmless SERA and its subconsultants from and against any claim, damage, liability, or cost, including attorneys' fees or expert costs that may arise as a result of Recipient's sharing of the Electronic Documents with third-parties, without compliance with this paragraph.

Electronic Documents to be supplied:

[Click here to enter text.](#)

SERA will transfer the Electronic Documents listed above after recipient executes and returns this Electronic Document Release to SERA.

Recipient agrees that its receipt and use of the Electronic Documents described above is subject to the conditions described in this Electronic Document Release, and Recipient agrees to those conditions.

Recipient Firm: _____

By Authorized Rep: _____

Title: _____

Date: _____

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Summary of Delegated Design Work.
- B. Delegated Design submittals.

1.02 DEFINITIONS

- A. Delegated Design: Those portions of the design not provided by the Architect or Engineer of Record which are to be provided by the Contractor . Where indicated within specification sections, provide materials or products that require analysis by a professional engineer. Engage licensed engineering services either directly, through a subcontractor, or through the building component manufacturer's engineer. Such work is subject to provisions of Section 00 72 00 - General Conditions; AIA Document A201 – General Conditions of the Contract for Construction § 3.12.10. Qualified professional engineers must be licensed in the state in which the project is located.
 - 1. Not all delegated design indicated requires the use of the services of a professional engineer, such materials or products may require the use of manufacturer's design tables for pre-engineered building components, reference standards or industry accepted reference manuals to fulfill the Delegated Design responsibilities of the Contractor .
 - 2. The terms "Delegated Design," and "Bidder Design" are used interchangeably.
- B. AHJ: Authorities Having Jurisdiction, defined in Section 01 10 00.

1.03 PERFORMANCE REQUIREMENTS

- A. Execute the design intent as indicated in Contract Documents.
- B. Comply with codes and regulations for state and local jurisdictions.
 - 1. In case of any conflict between referenced codes or standards and the Drawings and Specifications, the code or standard having the more stringent requirements shall govern.
- C. Provide complete, operational systems that perform to intended use.
- D. Engineer Delegated Design portions of the Work.
 - 1. For structural components refer to Structural Drawings.
 - 2. For architectural components refer to specification sections under Part 2 article "Performance Criteria"
 - 3. If not indicated, request performance criteria.
- E. Details of conditions for Delegated Design component are not all shown on the Drawings; final resolution of details shall be the responsibility of the Contractor such that the completed installation complies with the design and performance requirements.
- F. Deviations from design details indicated shall not alter the appearance of the completed work as determined by the Architect.

1.04 OWNER'S RESPONSIBILITIES

- A. Owner will not pay for delays, additional Work, additional products, restocking, or re-working required by Contractor 's failure to coordinate Delegated Design work with other Project work.

1.05 SUBMITTALS

- A. Delegated Design Submittals: Comply with submittal procedures in Section 01 30 00 for each Delegated Design portion of the Work. Provide Product Data, Shop Drawings and Samples as required to clearly show how Delegated Design component complies with Design Intent.

1.06 QUALITY ASSURANCE

- A. Documentation: Comply with requirements of AHJ.

- B. Engineer's Qualifications: A professional engineer who is experienced in design of the kind indicated and licensed in the State in which the Project is located.
- C. Pre-Submittal Meeting: Contractor shall meet with Architect, Architect's Consultant, and responsible Delegated Design Engineer to discuss requirements of the Work, submittals, scheduling and sequencing as necessary.

1.07 SCHEDULING

- A. Schedule design process and submittals required for Delegated Design portions to fit within Construction Schedule.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 SCHEDULE OF DELEGATED DESIGN AND DEFERRED SUBMITTALS

- A. Refer to Drawings for a list of delegated design submittals and additional submittal requirements.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Construction procedures appropriate for working with historic sites and structures.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: Contract descriptions, description of alterations work, work by others, future work, occupancy conditions, use of site and premises, and work sequence.
- B. Section 01 23 00 - Alternates: Descriptions of items, administrative requirements.
- C. Section 02 41 00 - Demolition: Selective demolition of nonhistoric elements.

1.03 DEFINITIONS

- A. Existing to Remain: Existing items that are not to be removed or dismantled. Protect materials as indicated.
- B. Historic: Spaces, areas, rooms, surfaces, materials, finishes, and overall appearance subject to preservation, rehabilitation, restoration, and reconstruction procedures defined in NPS (THP). Designation "HF" and words such as "historic," "historic fabric," "historic materials," "historic building materials," "historic character," or words of similar meaning indicate that the material or feature is considered to have aspects that require period treatment procedures.
- C. In-Kind: Matching existing in physical and visual aspects including, but not limited to, material, form, color, texture, and workmanship.
- D. Matching: Blending with adjacent construction and showing no apparent difference in material type, form, detail, color, texture, finish, or other visible and readily discernible characteristics, as determined and approved by Architect.
- E. Preserve: Apply measures to sustain existing form, integrity, and materials of a historic property; may include preliminary measures to protect and stabilize the property.
- F. Protect: Take precautions to keep historic materials of the building from damage or injury.
- G. Refinish: Remove existing finishes from base material and apply new finish to match original or as otherwise indicated.
- H. Remove: Detach or dismantle items from existing construction and dispose of them off-site, unless items are indicated to be salvaged or reinstalled.
- I. Remove and Reinstall: Detach or dismantle items from existing construction in a manner to prevent damage. Clean and prepare for reuse and reinstall in original location or in other location where indicated.
- J. 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.
- K. Replace: Remove, duplicate, and reinstall entire item with new material. Use original item as the pattern unless noted otherwise.

1.04 REFERENCE STANDARDS

- A. NPS (THP) - The Secretary of The Interior's Standards For the Treatment of Historic Properties with Guidelines For Preserving, Rehabilitating, Restoring & Reconstructing Historic Buildings.

PART 2 - PRODUCTS

2.01 PROTECTION PRODUCTS

- A. Adhesive Walk-Off, Tacky Mats: Mats with multiple layers of disposable, adhesive-coated sheets.

2.02 CLEANING MATERIALS

- A. General: Do not use incompatible materials that may contribute to damage of the element being cleaned.
- B. Use products specifically intended by the manufacturer for cleaning historic materials or elements.

2.03 REPAIR MATERIALS

- A. General: Do not use incompatible materials contributing to damage of repaired elements.
- B. Matching: Unless otherwise required, use new materials that match historic materials in type, design, dimension, texture, detailing, and external appearance.

PART 3 - EXECUTION

3.01 PERIOD TREATMENT SPECIAL PROCEDURES

- A. Review proposed procedures for each type of element with Architect. Obtain approval from [] before commencing work.
- B. Salvage as much existing material of each element as practicable; repair, consolidate, and restore rather than renew.
- C. Notify Owner of visible changes in the integrity of material or components, e.g., environmental, such as biological attack, ultraviolet degradation, freeze-thaw, or structural defects such as cracks, movement, or distortion.
- D. Protect existing materials and substrates from damage.
- E. Exterior Work Procedures: Protect parts of the facility not included in this work from damage.
- F. Interior Work Procedures: Protect parts of the facility not being cleaned or repaired from effects of this work.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Submittals.
- B. Testing and inspection agencies and services.
- C. Control of installation.
- D. Mock-ups.
- E. Tolerances.
- F. Manufacturers' field services.
- G. Defect Assessment.

1.02 REFERENCE STANDARDS

- A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants.
- B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation.
- C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry.
- 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.
- E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
- F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing.
- G. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components.

1.03 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mock-Up: Full-size, physical assemblies that are constructed on-site. Mock-ups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples.
 - 1. Accepted mock-ups establish the standard by which the Work will be judged.
- D. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
- J. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of 10 previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.04 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of Contract Documents, unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on the Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. When copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.
 - 2. When copies of standards are needed for any reason, obtain copies directly from publication source.
- D. Abbreviations and Acronyms for Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list.
 - 1. ADAAG or ADA: Americans with Disabilities Act
 - 2. CFR: Code of Federal Regulations
 - 3. DOD: Department of Defense Military Specifications and Standards
 - 4. FS: Federal Specification
 - 5. MILSPEC: Military Specification and Standards
 - 6. UFAS: Uniform Federal Accessibility Standards
- E. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale Research's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

1.05 CONFLICTING REQUIREMENTS

- A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but

apparently equal, to Architect for a decision before proceeding.

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

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Deficiencies Report: Attach a separate list of deficiencies identified in previous reports that have not been corrected and successfully retested.
1. Submit a final report certifying the status of all deficiencies, signed and stamped. Submit report directly to Authority having jurisdiction (when required) and copy to others.
- C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.
- D. Test Reports: After each test/inspection, promptly submit two copies of certified report to Architect, Contractor, Engineer of Record, Authority having jurisdiction, Owner, and Construction Manager. Include the following:
1. Date issued.
 2. Record of temperature and weather conditions at time of sample taking, testing and inspecting.
 3. Project title and number.
 4. Name of individuals making tests and inspections.
 5. Name, address, and telephone number of testing agency.
 6. Date and time of samples and tests or inspection.
 7. Identification of product and specifications section.
 8. Location in the Project.
 9. Description of the Work, including test and inspection method.
 10. Date of test/inspection.
 11. Results of tests and inspections, including complete test and inspection data.
 12. Test and inspection results and an interpretation of test results.
 13. Recommendations on retesting and reinspecting.
 14. Comments or professional opinion on whether tested or inspected Work is in conformance with Contract Documents.
 15. Name and signature of laboratory inspector.

1.07 REFERENCES AND STANDARDS

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of applicable reference code(s) enforced by authorities having jurisdiction.
- D. Obtain copies of standards and where required by product specification sections.

- E. Maintain copies of standards and codes at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- F. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- G. 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.

1.08 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. Owner will employ and pay for services of an independent testing agency to perform other specified testing.
 - 1. Owner's testing agent will perform "special inspections" required by Regulations.
- B. Contractor shall employ and pay for services of an independent testing agency to perform other testing and inspection specified as Contractor 's responsibility or required by Contractor for quality control.
- 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 the State in which the Project is located.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

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

3.02 MOCK-UP - GENERAL

- A. Before installing portions of the Work requiring mockups, build mock-up for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mock-up in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mock-up will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's acceptance of mock-up before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each additional review of mock-up.
5. Maintain mock-up during construction in an undisturbed condition as a standard for judging the completed Work.
- B. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- C. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- D. Accepted mock-up shall be a comparison standard for the remaining Work.
- E. 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.
 1. Deconstruct and recycle mock-up that is not incorporated in Work.

3.03 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.

3.04 TESTING AND INSPECTION

- A. See individual specification sections for testing and inspection required.
- B. Testing Agency Duties:
 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 2. Perform specified sampling and testing of products in accordance with specified standards.
 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
 5. Perform additional tests and inspections required by Architect.
 6. Submit reports of all tests/inspections specified.
- C. Limits on Testing/Inspection Agency Authority:
 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 2. Agency may not approve or accept any portion of the Work.
 3. Agency may not assume any duties of Contractor.
 4. Agency has no authority to stop the Work.
- D. Contractor Responsibilities:
 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.

3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide 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.
- G. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect. Payment for re testing will be charged to the Contractor by deducting testing charges from the Contract Price.

3.05 MANUFACTURERS' FIELD SERVICES

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

3.06 DEFECT ASSESSMENT

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

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 DEFINITIONS

- A. Products: Items purchased 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.
- B. 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.
- C. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or reused from other projects are not considered new products.
- D. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, 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.
- E. Substitutions: Contractor proposed changes in products, materials, equipment, or methods of construction different from those required by the Contract Documents.
- F. VOC: Volatile organic compound, carbon compounds that participate in atmospheric photochemical reactions and vaporize at normal room temperature. Measure as grams per liter, less water.
- G. Bidding/ Negotiating Period: The period within the project schedule where the Contractor receives bids or pricing from subcontracts or prepares their own bid to establish a contract value with the Owner.
- H. Award of Contract: The formal acceptance of the terms of the negotiation by the Contractor .
- I. Notice to Proceed: A document that establishes the date work is authorized to commence. It may also include the number of calendar days or date of substantial completion.

1.03 SUBMITTALS

- A. Submittal procedure for Product Data, Shop Drawings, Samples, and Certificates is specified in Section 01 30 00 - Administrative Requirements.
- B. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
 - 1. Submit within 15 days after date of Notice to Proceed.
 - 2. For products specified only by reference standards, list applicable reference standards.

- C. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- D. Request for Substitution: Submit approved form with supporting information to General Contractor. Comply with "Substitution Procedures" Article in this Section.
 - 1. Requests During Bidding/ Negotiating period: CSI Form 1.5C or current CSI Northwest Region Form.
 - 2. Requests after Bidding/Negotiating period: CSI Form 13.1A.
 - 3. Submit original request forms in quantity required distribution. Original must be signed by person authorized to certify the substitution request form. Architect may request proof of authorization.

1.04 QUALITY ASSURANCE

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

1.05 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: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 - 2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 - 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
 - 3. Refer to Divisions 2 through 48 Sections for specific content requirements and particular requirements for submitting special warranties.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

- A. 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.
- B. Reused Products: Reused products include materials and equipment salvaged and refurbished as specified.
 - 1. Protect, repair and prepare for installation items indicated as "reinstall" or "salvage for reinstallation".
 - 2. Replace items that are damaged beyond repair during demolition or construction.

2.02 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. Use of products having any of the following characteristics is not permitted:

1. Made using or containing CFC's or HCFC's.
2. Made of wood from newly cut old growth timber.
- C. Where other criteria are met, Contractor shall give preference to products that:
 1. If used on interior, have lower emissions, as defined in this Section.
 2. If wet-applied, have lower VOC content, as defined in this Section.
 3. Are made with rapidly renewable material.
 4. Contain more recycled material.
 5. Use sustainably harvested wood over non-sustainably harvested wood.
 6. Do not contain urea formaldehyde.
 7. Contain fewer VOCs.
 8. Are Green Label Plus carpet, cushion or adhesive.
 9. Have longer documented life span under normal use.
 10. Result in less construction waste. See Section 01 74 19
- D. Products with Recycled Content:
 1. Overall Project Preference: Provide products with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial recycled content constitutes at least 10 percent of the total value of all products installed, except mechanical and electrical components.
 2. Specific Product Categories: Provide recycled content as specified elsewhere.
 3. Calculations: Where information about recycled content is required to be submitted:
 - a. Determine percentage of post-consumer and post-industrial content separately, using the guidelines contained in 16 CFR 260.7(e).
 - b. Previously used, reused, refurbished, and salvaged products are not considered recycled.
 - c. Wood fabricated from timber abandoned in transit to original mill is considered reused, not recycled.
 - d. Determine percentage of recycled content of any item by dividing the weight of recycled content in the item by the total weight of all material in the item.
 - e. Determine value of recycled content of each item separately, by multiplying the content percentage by the value of the item.
 4. Submittals: State unit cost, post-consumer and post-industrial content percentages, quantity installed, total material cost, and total recycled content value; attach evidence of contents from either manufacturer or an independent agency.
- E. Urea-Formaldehyde Prohibition:
 1. Overall Project Requirement: Provide composite wood and agrifiber products having no added urea-formaldehyde resins. Laminating adhesives used to fabricate both on-site and shop-applied composite wood and agrifiber assemblies shall not contain urea formaldehyde resin.
 2. Specific Product Categories: Comply with limitations specified elsewhere.
 3. Products must comply with US Dept of Commerce (DOC) Voluntary Product Standard PS-1 or PS-2 or have third party certification as CARB ULEF label or SCS cal COMPLIant as NAUF or ULEF per CARB ATCM 93120.
- F. Adhesives and Sealants: Preference is given to products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District (SCAQMD) Rule No.1168, and Green Seal Standard for Commercial Adhesives GS-36. The following guidelines are provided as the preferred VOC limits for materials:
 1. Specific Product Categories: VOC in grams/Liter (g/L) shall not exceed:
 - a. Indoor Carpet Adhesive: 50 g/L.
 - b. Carpet Pad Adhesive: 50 g/L.
 - c. Wood Flooring Adhesive: 100 g/L.
 - d. Rubber Flooring Adhesive: 60 g/L.
 - e. Subfloor Adhesive: 50 g/L.

- f. VCT and Asphalt Adhesive: 50 g/L.
- g. Gypsum Board Adhesive: 50 g/L.
- h. Cove base adhesives: 50 g/L.
- i. Resilient Base Adhesive: 50 g/L.
- j. Multipurpose Construction Adhesive: 70 g/L.
- k. Structural Glazing Adhesive: 100 g/L.
- 2. Specialty Applications: VOC in grams/Liter (g/L) shall not exceed:
 - a. PVC Welding: 510 g/L.
 - b. CPVC Welding: 490 g/L.
 - c. ABS Welding: 325 g/L.
 - d. Plastic Cement Welding: 250 g/L.
 - e. Adhesive Primer for Plastic: 550 g/L.
 - f. Contact Adhesive: 80 g/L.
 - g. Special Purpose Contact Adhesive: 250 g/L.
 - h. Structural Wood Member Adhesive: 140 g/L.
 - i. Sheet Applied Rubber Lining Operations: 850 g/L.
 - j. Top and Trim Adhesive: 250 g/L.
- 3. Substrate Specific Applications: VOC in grams/Liter (g/L) shall not exceed:
 - a. Metal to Metal: 30 g/L.
 - b. Plastic Foams: 50 g/L.
 - c. Porous Material (except wood): 50 g/L.
 - d. Wood: 30 g/L.
 - e. Fiberglass: 80 g/L.
- 4. Sealants: VOC in grams/Liter (g/L) shall not exceed:
 - a. Architectural: 250 g/L.
 - b. Roof: 300 g/L.
 - c. Roadway: 250 g/L.
 - d. Single Ply Roof Membrane: 450 g/L.
 - e. Other: 250 g/L.
- 5. Primers for Sealants: VOC in grams/Liter (g/L) shall not exceed:
 - a. Architectural Non Porous: 250 g/L.
 - b. Architectural Porous: 775 g/L.
 - c. Other: 750 g/L.
- 6. Aerosol Adhesives: Percent VOC by weight shall not exceed:
 - a. General Purpose Mist Spray: 65 percent.
 - b. General Purpose Web Spray: 55 percent.
 - c. Special Purpose (all types): 70 percent.
- G. Interior Paints and Coatings: Preference is given to products having lower volatile organic compound (VOC) content than required by Green Seal Standards GS-11 and GC-03, SCAQMB Rule 1113, in grams/Liter, have been tested per California Department of Public Health Standard Method V1.1-2010, CA Section 01350 requirements. Provide Third Party Testing, documentation, and the following:
 - 1. VOC in grams/Liter (g/L) shall not exceed the following for each product:
 - a. Non-flat opaque products: 150 g/L.
 - b. Flat opaque products: 50 g/L.
 - c. Anti-corrosive paint: 250 g/L.
 - d. Floor coating: 100 g/L.
 - e. Clear varnish: 350 g/L.
 - f. Sealers:
 - 1) Waterproofing: 250 g/L
 - 2) Sanding: 250 g/L

- 3) All others: 200 g/L
- g. Shellacs:
 - 1) Clear: 730 g/L
 - 2) Pigmented: 550 g/L
- h. Stains: 250 g/L.
- 2. Comply with other requirements of GS-11 (component limitations, scrubbability, hiding power, washability).
- H. Carpet, Carpet Tile, Carpet Cushion and Adhesives: Provide only products having lower volatile organic compound (VOC) content than required by Carpet and Rug Institute Green Label Testing Program Limits, Emission Factor Limit in mg/sq. m. x hour as follows:
 - 1. Adhesive maximum VOC: 50 g/L
- I. Provide interchangeable components by the same manufacture for components being replaced.
- J. Cord and Plug: Provide minimum 6 foot cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.

2.03 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.
- D. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named.
- E. Visual Matching Specification: Where Specifications require matching an established Sample, select 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 provisions in "Product Substitutions" Article for proposal of product.
- F. Visual Selection Specification: Selection of products for color, pattern, density, or texture will be by Architect from Manufacturer's full range, unless indicated otherwise.
 - 1. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
 - 2. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.04 MAINTENANCE MATERIALS

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

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

- A. Substitutions during the bidding period will be allowed in accordance with the Instructions to Bidders or General Conditions. If not indicated, substitutions will be allowed up to and including 7 business days prior the date indicated to receive bids.
- B. Substitutions may be considered during construction when a product becomes unavailable through no fault of the Contractor.
- C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
 - 1. Note any departures from the Contract Documents or changes in previously reviewed submittals which were not commented upon in the initial review of information.
- D. A request for substitution constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
 - 2. Agrees to provide the same warranty for the substitution as for the specified product.
 - 3. Agrees to coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
 - 4. Waives claims for additional costs or time extension that may subsequently become apparent.
 - 5. Where "visual matching" is not possible, refer to paragraph in "Product Options" article in Part 2 above.
 - 6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
 - 7. Will reimburse the Architect for changes to the building design, including engineering design, detailing and additional Construction Administration services as a result of the proposed substitution.
- E. Conditions for Substitution after Bidding/ Negotiating Period: Architect will consider Contractor 's request for substitution 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:
 - 1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - 2. Requested substitution does not require revisions to the Contract Documents.
 - 3. Requested substitution is consistent with the Contract Documents and will produce indicated results including warranty, maintenance service or source replacement of parts.
 - 4. Requested substitution will not adversely affect Contractor 's Construction Schedule or the work of other trades.
 - 5. Requested substitution will not require changing specifications or affect the Owner's activities.
 - 6. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - 7. Requested substitution is compatible with other portions of the Work.
 - 8. Requested substitution has been coordinated with other portions of the Work.
 - 9. The Contractor agrees to reschedule activities around the required redesign time needed without changing Substantial Completion date and reimburse Architect for changes to the building design, including design, detailing and additional Construction Administration services as a result of the proposed substitution.

F. Substitutions will not be considered when they are indicated or implied on Shop Drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

1. Submit proposed substitution 14 days prior to submittal.

G. Substitution Submittal Procedure (after contract award):

1. Requests during Procurement (Bidding): Specified in Procurement Documents.

2. Requests after Bidding/ Negotiating Period : Architect will notify Contractor in writing of decision to accept or reject request.

3.02 OWNER-FURNISHED PRODUCTS (CONTRACTOR INSTALLED)

A. Owner's Responsibilities:

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

2. Arrange and pay for product delivery to site.

3. On delivery, inspect products jointly with Contractor.

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

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

B. Contractor's Responsibilities:

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

2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.

3. Handle, store, install and finish products.

4. Repair or replace items damaged after receipt.

3.03 OWNER-FURNISHED PRODUCTS (OWNER INSTALLED)

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. Install and finish products.

7. Repair or replace items damaged after receipt.

B. Contractor 's Responsibilities:

1. Review Owner reviewed shop drawings, product data, and samples to prepare areas to receive Owner's installation.

2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.

3. Handle and store products.

3.04 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 a manner 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.

3.05 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 74 19.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.
- G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- H. Comply with manufacturer's warranty conditions, if any.
- I. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- J. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- K. Prevent contact with material that may cause corrosion, discoloration, or staining.
- L. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION



**The Construction Specifications Institute
Northwest Region**

SUBSTITUTION REQUEST

TO: _____

PROJECT: _____

SPECIFIED ITEM: _____

Section	Page	Paragraph	Description
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PROPOSED SUBSTITUTION: _____

Attached data includes product description, specifications, drawings, photographs, performance and test data adequate for evaluation of request. Applicable data is clearly identified.

Attached data also includes description of changes to Contract Documents the proposed substitution requires for its proper installation.

Undersigned certifies following items, unless modified by attachments, are correct:

1. Proposed substitution does not affect dimensions shown on drawings.
2. Undersigned will pay for changes to building design, including engineering design, detailing, and construction costs caused by proposed substitution.
3. Proposed substitution has no adverse effect on other trades, construction schedule, or specified warranty requirements.
4. Maintenance and service parts are available locally or are readily obtainable for proposed substitution.

Undersigned further certifies the function, appearance, and quality of the proposed substitution are equivalent or superior to the specified item.

Undersigned agrees, if this page is reproduced, the terms and conditions for substitutions found in Bidding Documents apply to this proposed substitution.

Submitted by:

Name (printed or typed)

Signature

Firm Name

Address

City, State, Zip

Date

Telephone

Fax

General Contractor (if after award of Contract)

For use by A/E

- Approved
- Approved as Noted
- Not Approved
- Received Too Late

By _____

Date _____

Remarks _____

List of Attachments:



SUBSTITUTION REQUEST

(After the Bidding/Negotiating Stage)

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.: _____
Installer: _____	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 ☐ _____

SUBSTITUTION REQUEST

(After the Bidding/Negotiating Stage - 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 ACTION

- ☐ Substitution approved – Make submittals in accordance with Specifications Section 01 60 00 Product Requirements.
- ☐ Substitution approved as noted – Make submittals in accordance with Specification Section 01 60 00 Product Requirements.
- ☐ Substitution rejected – Use specified materials.
- ☐ Substitution Request received too late – Use specified materials.

Signed by: _____

Date: _____

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E ☐ _____

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Delegated Design Submittal:
 - 1. Refer to Section 01 35 73 for additional delegated design requirements.
 - 2. Provide Shop Drawings as required by AHJ, stamped and signed by engineer responsible for design.
- C. Cutting and Patching: If not shown in Documents, submit an RFI 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.
- D. Substantial Completion Documents: Statement that Project is substantially complete and list of incomplete items (Punch List).
 - 1. Submit 1 copy.
 - 2. Other items listed under Substantial Completion in Part 3.
- E. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.03 QUALIFICATIONS

- A. Engineer Qualifications: Temporary shoring and supports for excavations to be engineered 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. For survey work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate to be kept on file in Contractor's office.

1.04 PROJECT CONDITIONS

- A. Use of explosives is not permitted.
- B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

- C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- D. Perform dewatering activities, as required, for the duration of the project.
- E. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- F. 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, as required by Authority Having Jurisdiction (AHJ).
 - 1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
 - 2. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.
- G. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
 - 1. Minimize amount of bare soil exposed at one time.
 - 2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
 - 3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
 - 4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
- H. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations, as required by Authority Having Jurisdiction (AHJ).
- I. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
- J. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.
- K. 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.

1.05 COORDINATION

- A. See Section 01 10 00 for occupancy-related requirements.
- B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- C. Notify affected utility companies and comply with their requirements.
- D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

- G. Coordinate completion and clean-up of work of separate sections.
- H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

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

3.03 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Contractor shall locate and protect survey control and reference points.
- D. Control datum for survey is that established by Owner provided survey.
- E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

- F. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- H. Utilize recognized engineering survey practices.
- I. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.
- J. 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.
- K. Periodically verify layouts by same means.
- L. Maintain a complete and accurate log of control and survey work as it progresses.
- M. On completion of foundation walls and major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.

3.04 GENERAL INSTALLATION REQUIREMENTS

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

3.05 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
 - 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 09 21 16, utilizing sealant to eliminate sound and light leaks between demolition/construction and Owner occupied spaces in locations indicated on drawings.
- C. 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.
- D. 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.
- E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
 1. Maintain existing active systems that are to remain in operation with temporary connections to maintain services during duration of Work.
 2. 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.
 3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
 - b. See Section 01 10 00 for other limitations on outages and required notifications.
 - c. Provide temporary connections as required to maintain existing systems in service.
 4. Verify that abandoned services serve only abandoned facilities.
 5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
- F. 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.
- G. 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.
 4. Trim existing wood doors as necessary to clear new floor finish. Refinish trim as required.
- H. 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.
- I. 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, proceed as follows:
 - a. Notify Architect before proceeding if proposed repair will have aesthetic effect.
 - b. Repair or replace damaged mechanical or electrical work compliant with Divisions 21, 22, 23, 25, 26, 27 and 28.
 - c. Patch finish to match adjacent surfaces.
- J. Clean existing systems and equipment.
- K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- L. Do not begin new construction in alterations areas before demolition is complete.

3.06 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. See Alterations article above for additional requirements.
- C. Perform whatever cutting and patching is necessary to:
 1. Complete the work.
 2. Fit products together to integrate with other work.
 3. Provide openings for penetration of mechanical, electrical, and other services.
 4. Match work that has been cut to adjacent work.
 5. Repair areas adjacent to cuts to required condition.
 6. Repair new work damaged by subsequent work.
 7. Remove samples of installed work for testing when requested.
 8. Remove and replace defective and non-complying work.
- D. Execute cutting and patching including excavation and fill to complete the work, to uncover work in order to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing when requested, to provide openings in the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit products together to integrate with other 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 original condition.
- F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
 1. Do not overcut at corners of masonry, concrete, metals and similar rigid materials.
- G. Restore work with new products in accordance with requirements of Contract Documents.
- H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.
- J. Patching:
 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
 2. Match color, texture, and appearance.
 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

- K. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
- L. Make neat transitions. Patch work to match adjacent work in texture and appearance. Where new work abuts or aligns with existing, provide a smooth and even transition.

3.07 PROGRESS CLEANING

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

3.08 PROTECTION OF INSTALLED WORK

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

3.09 SYSTEM STARTUP

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

3.10 DEMONSTRATION AND INSTRUCTION

- A. See Section 01 79 00 - Demonstration and Training.

3.11 ADJUSTING

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

3.12 FINAL CLEANING

- A. Execute final cleaning prior to final project assessment.
 - 1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.
- B. Use cleaning materials that are nonhazardous and will not damage the Work.
- C. 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.
- D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- F. Clean filters of operating equipment.
- G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.
- H. Clean site; sweep paved areas, rake clean landscaped surfaces.
- I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.13 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
 - 1. Provide copies to Architect.
- B. Accompany Contractor on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
- C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
- D. Substantial Completion: Submit written statement 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 review.
 - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - a. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
 - b. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 - c. Include the following information at the top of each page: Project name; Date; Name of Architect; Name of Contractor ; Page number.
 - 2. Advise Owner of pending insurance changeover requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction digital photographs, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- E. Certificate of Substantial Completion: On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
 1. Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Re-inspection is Extraordinary Contract Administration Service, Section 01 20 00.
 3. Results of completed inspection will form the basis of requirement for Final Completion.
- 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.
- H. Notify Architect when work is ready for Final Completion.
 1. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 2. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 3. Submit pest-control final inspection report and warranty.
 4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- I. Final Completion: On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will certify a final Certificate for Payment after inspection or will notify Contractor of work that must be completed or corrected before certificate will be issued.
- J. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.
 1. Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

2. Re-inspection is Extraordinary Contract Administration Service, Section 01 20 00.

3.14 MAINTENANCE

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

END OF SECTION

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

- A. Owner requires that this project generate the least amount of trash and waste possible.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- D. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
 - 1. The following strategies do not qualify as recycling:
 - a. Packing unused material into wall cavities
 - b. Grinding treated or finished wood for a soil amendment
 - c. Waste that is used as Alternative Daily Cover (ADC) at a landfill or industrial waste stabilizer.
 - d. On-site incineration and waste-to-electricity incineration
 - 2. The following methods for diverting material from landfill is acceptable:
 - a. On-site grinding of untreated cellulosic material and gypsum for use as a soil amendment.
 - b. Third-party scrap reuse of scrap
 - 3. Do not include demolition or land clearing debris in calculations of recycled materials. Include materials destined for Alternative Daily Cover (ADC) such as gypsum board in the calculations as waste (not recycled).
 - 4. Do not include hazardous waste or hazardous materials in calculations. These can be excluded from quantity of total waste.
- E. The project as targeted requires that 95 percent, by weight, of potential landfill trash/waste is diverted by recycling or salvage.
- F. Submit periodic Waste Disposal Reports; all landfill disposal, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.
- G. Develop, follow and submit to Architect for review a Waste Management Plan.
- H. Methods of trash/waste disposal that are not acceptable are:
 - 1. Burning on the project site.
 - 2. Burying on the project site.
 - 3. Dumping or burying on other property, public or private.
 - 4. Other illegal dumping or burying.
 - 5. Incineration, either on- or off-site.
- I. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 DEFINITIONS

- A. Alternative Daily Cover (ADC): Material other than earthen material placed on the surface of the active face of a municipal solid waste landfill at the end of each operating day to control vectors, fires, odors, blowing litter, and scavenging. Generally these materials must be processed so they do not allow gaps in the exposed landfill face. (CalRecycle).
- B. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

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

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Submit Waste Management Plan within 10 calendar days after receipt of Notice of Award of Bid, or prior to any trash or waste removal, whichever occurs sooner; submit projection of all trash and waste that will require disposal and alternatives to landfilling.
- C. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
 - 1. Submit Report on a form acceptable to Owner.
 - 2. Landfill Disposal: Include the following information:
 - a. Identification of material.

- b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.
- c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
- d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
- 3. Recycled and Salvaged Materials: Include the following information for each:
 - a. Identification of material, including those retrieved by installer for use on other projects.
 - b. Amount, in tons or cubic yards, date removed from the project site, and receiving party.
 - c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 - e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
- 4. Material Reused on Project: Include the following information for each:
 - a. Identification of material and how it was used in the project.
 - b. Amount, in tons or cubic yards.
 - c. Include weight tickets as evidence of quantity.
- 5. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

- A. See Section 01 30 00 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. See Section 01 60 00 for waste prevention requirements related to delivery, storage, and handling.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.
- B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.
- C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- D. Meetings: Discuss trash/waste management goals and issues at project meetings.
 - 1. Prebid meeting.
 - 2. Preconstruction meeting.
 - 3. Regular job-site meetings.
- E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
 - 1. As a minimum, provide:

- a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
- b. Separate dumpsters for each category of recyclable.
- c. Recycling bins at worker lunch area.
2. Label containers and areas with durable, weather-resistant signs. Use clear simple language. Use multiple languages spoken at Project Site.
3. Provide containers as required.
4. Provide adequate space for pick-up and delivery and convenience to subcontractors.
5. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- F. Alternative to Site Separation: Material Recovery Facility that provides specified documentation is acceptable in lieu of source-separated recycling facilities.
- G. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
- H. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
- I. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.
- J. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project record documents.
- B. Operation and Maintenance Manuals.
 - 1. Preliminary Operation and Maintenance Manual at partial completion.
- C. Warranties (and Bonds) Manual.

1.02 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
 - 1. Submit one copy of preliminary manual before 75 percent of Work is complete. Include table of contents, outline contents of each section, and at least one typical finish section complete, and one equipment section complete. Architect will review preliminary and return one copy with comments.
 - a. Applications for payment equal to and greater than 75 percent will not be certified until preliminary manual is submitted.
 - 2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
 - 3. Submit electronic copy of completed documents 15 days prior to Substantial Completion. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
 - 4. Submit electronic copy of revised final documents in final form within 10 days after request for final payment or request for final inspection, whichever is first.
- C. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. Items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.

1. Review current information with Architect prior to each Application for Payment. This is a condition for payment. See Section 01 20 00
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 1. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 1. Measured depths of foundations in relation to finish first floor datum.
 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 3. Field changes of dimension and detail.
 4. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA - GENERAL

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

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
 1. Product data, with catalog number, size, composition, and color and texture designations.
 2. Information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 1. Description of unit or system, and component parts.
 2. Identify function, normal operating characteristics, and limiting conditions.
 3. Include performance curves, with engineering data and tests.
 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. 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.

- D. 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.
- E. Provide servicing and lubrication schedule, and list of lubricants required.
- F. Include manufacturer's printed operation and maintenance instructions.
- G. Include sequence of operation by controls manufacturer.
- H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- I. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLING OPERATION AND MAINTENANCE MANUALS

- A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.
- B. Prepare data in the form of an instructional manual.
- 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.
 - 1. Subtitle binders by Volume Number and CSI sub group title or CSI division title as appropriate.
- D. Cover: Identify each binder with printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify Subtitle appropriate for subject matter of contents, Month and Year of Substantial Completion.
- E. Table of Contents: Project name on each page; list products and systems included in Volume, indexed by CSI Section number.
- F. Information Page: Project name; names, addresses, and telephone numbers of Architect , Consultants, and Contractor with name of responsible parties; date of substantial completion.
- G. Index of Products: Table that can be sorted by word processor or spreadsheet; printed and digital formats; include product information under the following column headings:
 - 1. Product Name
 - 2. Manufacturer
 - 3. Model number
 - 4. O&M Volume Number
 - 5. Section Number
- H. Arrange content by systems under Section numbers and sequence of Table of Contents of this Project Manual.
- I. Provide tabbed dividers for each separate product or system, with Specification Section number and product name.
 - 1. Product Summary: On divider page or a separate first page indicate Specification Section number and title, product or system name, manufacturer, model, major components, supplier and installer information.
- J. Text: Manufacturer's printed or typewritten information on 20 pound paper.
- K. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- L. Elevator Operation and Maintenance Manual: Submit an additional copy of information for elevator in a separate manual, formatted similar to primary manual. This Manual will be kept in Elevator Machine Room.

1. When Project includes more than one Elevator Machine Room, provide separate manuals with information for elevators served by that machine room.

3.06 WARRANTIES AND BONDS MANUAL

- 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.
 1. Always provide, at a minimum, the responsible Subcontractor's, supplier's and manufacturer's standard product warranty unless noted otherwise in the individual specification sections.
 2. All listed manufacturers and all listed installers through the act of submitting a bid are confirming obligatory responsibility for providing an equal quantity and equal quality warranty to the design basis warranties listed, unless individual specification sections note otherwise.
- 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.
 1. Do not include "And Bonds" when Project does not include bonds.
- G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
- H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- 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. Landscape irrigation.
- 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.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate training schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instructional program until operation and maintenance data has been reviewed and approved by Architect.

1.03 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 not less than four weeks prior to start of training.
 - 2. Revise and resubmit until acceptable.
 - 3. Provide an overall schedule showing all training sessions.
 - 4. Include at least the following for each training session:
 - a. Identification, date, time, and duration.
 - b. Description of products and/or systems to be covered.
 - c. Name of firm and person conducting training; include qualifications.
 - d. Intended audience, such as job description.
 - e. Objectives of training and suggested methods of ensuring adequate training.
 - f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
 - g. Media to be used, such as slides, hand-outs, etc.
 - h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.
- C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
 - 1. Include applicable portion of Operation and Maintenance manuals.
 - 2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in Operation and Maintenance 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.

1.04 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

3.01 DEMONSTRATION - GENERAL

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
- B. 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.

3.02 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:
 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

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.
 - 1. Protect and Existing to Remain have the same meaning regarding work in this Section.

1.03 MATERIALS OWNERSHIP

- A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.
 - 1. Coordinate with Owner's historical adviser, who will establish special procedures for removal and salvage.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Demolition Plan: Submit demolition plan as required by OSHA and local AHJs.
 - 1. Indicate extent of demolition, removal sequencing, and location and construction of barricades and fences.
 - 2. Summary of safety procedures.
 - 3. Demolition firm qualifications.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.05 PROJECT CONDITIONS

- A. 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.
- B. Comply with other requirements specified in Section 01 7000.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Comply with applicable requirements of NFPA 241.
 - 3. Provide, erect, and maintain temporary barriers and security devices.

4. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
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.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Do not begin removal until built elements to be salvaged or relocated have been removed.
- D. Protect existing structures and other elements to remain in place and not removed.
 1. Prevent movement or settlement of adjacent structures.
 2. Stop work immediately if adjacent structures appear to be in danger.
- E. 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.
- F. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, mercury, and mold.
- G. Perform demolition in a manner that maximizes salvage and recycling of materials.
 1. Dismantle existing construction and separate materials.
 2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

3.02 EXISTING UTILITIES

- A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone. Identify and mark, in same manner as other utilities to remain, utilities to be reconnected.

3.03 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.
 1. Verify construction and utility arrangements are as indicated.
 2. Report discrepancies to Architect before disturbing existing installation.
 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

- B. Remove existing work as indicated and required to accomplish new work.
 - 1. Remove items indicated on drawings.
- C. Protect existing work to remain.
 - 1. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
 - 2. Repair adjacent construction and finishes damaged during removal work.
 - 3. Patch to match new work.

3.04 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Remove materials not to be reused on site; comply with requirements of Section 01 74 19 Construction Waste and Management and Disposal.
- C. Leave site in clean condition, ready for subsequent work.
- D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Floors and slabs on grade.
- B. Concrete reinforcement.
- C. Joint devices associated with concrete work.
- D. Concrete curing.

1.02 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.
 - 1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.
 - 2. For chemical-resistant waterstops, provide data on ASTM D471 test results.
- C. Mix Design: Submit proposed concrete mix design.
 - 1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
 - 2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.
- D. Test Reports: Submit report for each test or series of tests specified.
- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.03 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
- B. Follow recommendations of ACI 305R when concreting during hot weather.
- C. Follow recommendations of ACI 306R when concreting during cold weather.
- D. For slabs required to include moisture vapor reducing admixture (MVRA), do not proceed with placement unless manufacturer's representative is present for every day of placement.

1.04 WARRANTY

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

PART 2 PRODUCTS

2.01 REINFORCEMENT MATERIALS

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
 - 1. Type: Deformed billet-steel bars.
 - 2. Finish: Unfinished, unless otherwise indicated.
- B. Reinforcement Accessories:
 - 1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch.
 - 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
 - 3. Provide stainless steel, galvanized, plastic, or plastic coated steel components for placement within 1-1/2 inches of weathering surfaces.

2.02 CONCRETE MATERIALS

- A. Cement: ASTM C150/C150M, Type I or Type I/II - Normal Portland type.
 - 1. Acquire cement for entire project from same source.

- B. Fine and Coarse Aggregates: ASTM C33/C33M.
 - 1. Acquire aggregates for entire project from same source.
- C. Fly Ash: ASTM C618, Class C or F.
- D. Calcined Pozzolan: ASTM C618, Class N.
- E. Silica Fume: ASTM C1240, proportioned in accordance with ACI 211.1.
- F. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.03 ADMIXTURES

- A. Air Entrainment Admixture: ASTM C260/C260M.
 - 1. Manufacturers:
 - a. Substitutions: See Section 01 60 00 - Product Requirements.
- B. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.
 - 1. Manufacturers:
 - a. Substitutions: See Section 01 60 00 - Product Requirements.
- C. High Range Water Reducing Admixture: ASTM C494/C494M Type F.
 - 1. Manufacturers:
 - a. Euclid Chemical Company; PLASTOL 6420: www.euclidchemical.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Water Reducing and Accelerating Admixture: ASTM C494/C494M Type E.
 - 1. Manufacturers:
 - a. Euclid Chemical Company; ACCELGUARD 80: www.euclidchemical.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Water Reducing Admixture: ASTM C494/C494M Type A.
 - 1. Manufacturers:
 - a. Euclid Chemical Company; EUCON NW: www.euclidchemical.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 ACCESSORY MATERIALS

- A. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
 - 1. Grout: Comply with ASTM C1107/C1107M.
 - 2. Height Change, Plastic State; when tested in accordance with ASTM C827/C827M:
 - a. Maximum: Plus 4 percent.
 - b. Minimum: Plus 1 percent.
 - 3. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch.
 - 4. Products containing aluminum powder are not permitted.
 - 5. Flowable Products:
 - a. Kaufman Products Inc; SureGrout: www.kaufmanproducts.net/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 BONDING AND JOINTING PRODUCTS

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

2.06 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
 - 1. Replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with ACI recommendations.
- B. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.

C. Normal Weight Concrete:

1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 3,000 pounds per square inch.
2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
3. Calcined Pozzolan Content: Maximum 10 percent of cementitious materials by weight.
4. Silica Fume Content: Maximum 5 percent of cementitious materials by weight.
5. Water-Cement Ratio: Maximum 40 percent by weight.
6. Total Air Content: 4 percent, determined in accordance with ASTM C173/C173M.
7. Maximum Slump: 4 inches.
8. Maximum Aggregate Size: 5/8 inch.

2.07 MIXING

- A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685/C685M. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.
- B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

- A. Verify that forms are clean and free of rust before applying release agent.
- B. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- C. Prepare existing concrete surfaces to be repaired according to ICRI 310.2R.
- D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in accordance with bonding agent manufacturer's instructions.
- E. Where new concrete with integral waterproofing is to be bonded to previously placed concrete, prepare surfaces to be treated in accordance with waterproofing manufacturer's instructions. Saturate cold joint surface with clean water, and remove excess water before application of coat of waterproofing admixture slurry. Apply slurry coat uniformly with semi-stiff bristle brush at rate recommended by waterproofing manufacturer.
- F. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

- A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.
- B. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

3.04 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Place concrete for floor slabs in accordance with ACI 302.1R.

- C. Notify Architect not less than 24 hours prior to commencement of placement operations.
- D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- E. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.05 SLAB JOINTING

- A. Locate joints to reduce and minimize potential cracking.
- B. Anchor joint fillers and devices to prevent movement during concrete placement.
- C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
- D. Load Transfer Construction and Contraction Joints: Install load transfer devices as indicated; saw cut joint at surface as indicated for contraction joints.

3.06 FLOOR FLATNESS AND LEVELNESS TOLERANCES

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

3.07 CONCRETE FINISHING

- A. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
 - 1. Surfaces to Receive Thick Floor Coverings: "Wood float" as described in ACI 302.1R; thick floor coverings include quarry tile, ceramic tile, and Portland cement terrazzo with full bed setting system.
 - 2. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.
 - 3. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.

3.08 CURING AND PROTECTION

- A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
 - 1. Normal concrete: Not less than seven days.
- C. Surfaces Not in Contact with Forms:
 - 1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.
 - 2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
 - 3. Final Curing: Begin after initial curing but before surface is dry.

3.09 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- D. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.
- E. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cubic yards or less of each class of concrete placed.
- F. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
- G. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.
- H. Slab Testing: Cooperate with manufacturer of specified moisture vapor reducing admixture (MVRA) to allow access for sampling and testing concrete for compliance with warranty requirements.
- I. Permeability Test: Test concrete with waterproofing admixture according to COE CRD-C 48.

3.10 DEFECTIVE CONCRETE

- A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.
- B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.
- C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.
- D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.11 PROTECTION

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

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Liquid applied, gypsum based self-leveling floor underlayment of type and following accessories:
 - 1. Primer for underlayment adhesion to substrate.
 - 2. Sealer for underlayment to provide moisture-resistance and enhance floor finish adhesion.
 - 3. Sound attenuating acoustical mat.
 - 4. Accessories.

1.02 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data sheets documenting physical characteristics and product limitations of underlayment materials. Include information on surface preparation, mixing instructions, environmental limitations, and installation instructions.
 - 1. Include product data for sealer, demonstrating compatibility with underlayment and finish floor materials and adhesives.
- C. Manufacturer's Documentation: Verify mix expiration dates are not exceeded.
- D. Certificate of compliance that underlayment materials conform to requirements for the required fire rated assembly.
- E. Certificate: Certify that products meet or exceed specified requirements.
- F. Manufacturer's Instructions.

1.03 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the work of this section, with minimum five years experience.
- B. Provide priming and sealing materials certified by manufacturer to be compatible with substrates, underlayment, and other topical floor finish materials and that will not adversely affect underlayment or interfere with application of floor finishes.

1.04 DELIVERY, STORAGE, AND HANDLING

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

1.05 FIELD CONDITIONS

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

1.06 WARRANTY

- A. Refer to Section 01 78 00 - Closeout Submittals.
- B. Provide manufacturer's standard limited materials warranty, which includes defects in the manufacture of products provided.
 - 1. Warranty Period: 5 years from date of installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design; Cementitious Underlayment:
 - 1. Basis of Design: ARDEX Engineered Cement; Cementitious; ARDEX K 15 and ARDEX FEATHERFINISH: www.ardexamericas.com.
- B. Substitutions:
 - 1. See Section 01 60 00 - Product Requirements.

2.02 REGULATORY REQUIREMENTS

- A. Conform to applicable code for combustibility or flame spread requirements.
- B. Conform to applicable code acoustical requirements for following:
 - 1. Air-borne Sounds: Walls, partitions, and floor/ceiling assemblies separating dwelling units from each other, from public areas, or from service areas, shall have a sound transmission class (STC) rating of not less than 50 for air-borne noise when tested in accordance with ASTM E90.
 - 2. Structure-borne Sound: Floor/ceiling assemblies between dwelling units, or between a dwelling unit and a public or service area within the structure shall have an impact insulation class (IIC) rating of not less than 50 when tested in accordance with ASTM E492.

2.03 MATERIALS

- A. Cementitious Underlayment: Blended cement mix, that when mixed with water in accordance with manufacturer's directions will produce self-leveling underlayment with the following properties:
 - 1. Applications: To be applied in locations where Remeidal Floor Coating is applied due to elevated moisture or pH levels in concrete slabs as determined from Field Testing prior to installation of flooring materials, refer to Section 09 05 61.
 - 2. Compressive Strength: Minimum 3500 psi, tested per ASTM C472.
 - 3. Flexural Strength: Minimum 1000 psi after 28 days, tested per ASTM C348.
 - 4. Density: Minimum 115 lb/cu ft. maximum 125 lb/cu ft.
 - 5. Final Set Time: 1-1/2 to 2 hours, maximum.
 - 6. Thickness: Capable of thicknesses from feather edge to maximum 3-1/2 inch.
 - 7. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0 in accordance with ASTM E84.
- B. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to underlayment mix materials.
- C. Cementitious Primer: Manufacturer's recommended type.
- D. Joint and Crack Filler: Latex based filler, as recommended by manufacturer.

2.04 MIXING

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

2.05 ACCESSORIES

- A. Tape: Sealing tape for application to wood stud wall framing to stop moisture migration into wood from underlayment.
- B. Sealant: Elastomeric Sealant, see Section 07 92 00 - Joint Sealants.
- C. Perimeter Isolation:
 - 1. Isolation Strips: Polyethylene isolation material as recommended by manufacturer, minimum 1/4 inch thick.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

- A. Remove substrate surface irregularities. Fill voids and deck joints with filler. Finish smooth.
- B. Vacuum clean surfaces.
- C. Apply primer to substrate in accordance with manufacturer's instructions. Allow to dry.
- D. Close floor openings to prevent leakage of slurry during application of underlayment.

3.03 APPLICATION

- A. Install underlayment in accordance with manufacturer's instructions.
- B. Repair holes, rips, tears, and joints in acoustic mat in accordance with manufacturer's recommendations prior to placing gypsum underlayment.
 - 1. Acoustic underlayment shall be sealed to prevent gypsum underlayment from directly contacting structural substrate
- C. Pump or pour material onto substrate. Do not retemper or add water.
 - 1. Pump, move, and screed while the material is still highly flowable.
 - 2. Be careful not to create cold joints.
 - 3. Wear rubber peg finishing shoes while working in the wet material to avoid leaving marks.
- D. Place to indicated thickness, with top surface level to 1/8 inch in 10 ft.
- E. Place after partition installation.

3.04 CURING

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

3.05 APPLICATION - PRIMER/SEALER

- A. Standard Primer/Sealer: Apply Standard Primer/Sealer to areas scheduled to receive glue-down floor goods.
- B. Floor Goods Procedures: Refer to manufacturer's "Procedures for Attaching Finished Floor Goods to Underlayments" brochure for guidelines for installing finished floor goods.
 - 1. Any floor areas where the surface has been damaged shall be cleaned and sealed regardless of floor covering or location.
 - 2. Where floor goods manufacturers require special adhesive or installation systems, their requirements supersede these recommendations.

3.06 PROTECTION

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

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Steel handrails.
- B. Shop fabricated steel items.
- C. Manufactured metal items.
- D. Delegated Design of selected items indicated in Part 2 below.

1.02 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Delegated Design Submittal:
 - 1. Refer to Section 01 35 73 for additional delegated design requirements.
 - 2. Provide engineering calculations for components indicated in Part 2 below, based on Project Requirements and Performance Criteria indicated, signed and sealed by the professional engineer responsible for preparation.
- C. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
 - 2. Provide engineers stamp and signature on each sheet of shop drawings for delegated design components.
- D. Samples: Manufactured units.

1.03 QUALITY ASSURANCE

- A. Engineer Qualifications: Building components to be engineered under direct supervision of a Professional Engineer experienced in design of this Work and licensed in the State in which the Project is located.

PART 2 PRODUCTS

2.01 PERFORMANCE CRITERIA

- A. Delegated Design handrail assemblies:
 - 1. Design and fabricate to support a uniform load of 50 pounds per linear foot and a concentrated load of 200 pounds.
 - 2. Intermediate rails shall support a concentrated load of 50 pounds
 - 3. Components shall meet loading requirements in accordance with ASCE 7
 - 4. Design and fabrication of railings in lengths longer than 12 feet are required to meet more stringent requirements than industry standards to achieve a visual aesthetic straight line appearance without bulges or depressions and higher level of tolerance in joint smoothness without gaps.

2.02 MATERIALS - STEEL

- A. Steel Sections: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A 53/A 53M Grade B Schedule 40, black finish.
- E. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.
- F. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.

- G. Fasteners - exposed to view: Stainless Steel Nuts, Bolts, Metal Screws, Rods and Clevises as shown on drawings. Neoprene washers to be used to separate dissimilar materials. Do not use metals which are corrosive or incompatible with materials joined.
- H. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.
- I. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- J. Touch-Up Primer for Galvanized Surfaces, Shop and Field: SSPC-Paint 20, Type II - Organic, complying with VOC limitations of authorities having jurisdiction.
 - 1. Modified Polyamidoamine Epoxy Primer; Tnemec Company, Inc; Series 135 Chembuild. Tint to match zinc.

2.03 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.04 FABRICATED ITEMS

- A. Delegated Design Railings:
 - 1. General: Fabricate and install metal railings to meet design criteria indicated below. Design as indicated in Drawings and complying with regulations of the authority having jurisdiction. Provide structural connections to building structure, fabricate components in largest practical sizes for delivery to site.
 - 2. Fabrication:
 - a. Aesthetic Design Intent: As indicated in Drawings.
 - b. Material: Round or rectangular structural steel pipe or tube complying with referenced standards.
 - c. Construction: Fully welded.
 - d. Dimensions: As indicated in Drawings.
 - e. Railing Conditions:
 - 1) Wall mounted handrails.
 - f. Accessories: Per anchoring and securing requirements.
 - 3. Metal Jointing and Finish Quality Levels:
 - a. Architectural: All joints as inconspicuous as possible, whether welded or mechanical.
 - 1) Welded Joints: Continuously welded and ground smooth and flush.
 - (a) Carbon Steel: Perform welding in accordance with AWS D 1.1/D1.1M.
 - (b) Stainless Steel: Perform welding in accordance with AWS D 1.6.
 - 2) Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
 - 3) Exposed Edges and Corners: Eased to small uniform radius.
 - 4) Metal Surfaces to be Painted: Sanded or ground smooth, straight, and suitable for highest quality gloss finish without bulges or divets.
- B. Delegated Design Above Ceiling Supports: Design and fabricate for loads and seismic bracing of components and assemblies indicated as mounting to ceilings or soffits of suspended ceiling systems in accordance with the most stringent structural seismic requirements and authority having jurisdiction regulations and requirements. Factory or shop-fabricate to design indicated, to suit specific project conditions, and for structurally designed connection to building structure, in largest practical sizes for delivery to site.
 - 1. Finish: Factory-applied, rust-inhibiting thermoset acrylic enamel finish.

2.05 FINISHES - STEEL

- A. Prime paint steel items.
 - 1. Exceptions: Galvanize items to be embedded in or in contact with concrete or masonry.
 - 2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
 - 3. Exception: Miscellaneous steel receiving high performance coatings or shop applied metal coating finishes.
- B. Prime Painting: One coat, minimum 2.5 mils dry film thickness.
- C. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements.
- D. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.
- E. Galvanizing Repair Paint: Master Painters Institute (MPI) #18, #19, or SSPC Paint #20.

2.06 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

3.01 EXAMINATION

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

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Furnish setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Obtain approval prior to site cutting or making adjustments not scheduled.
- D. After erection, prime welds, abrasions and surfaces not shop primed or galvanized , except surfaces to be in contact with concrete.

3.04 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

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Miscellaneous framing and sheathing.

1.02 RELATED REQUIREMENTS

- A. Section 09 21 16 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- B. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
- C. PS 1 - Structural Plywood.
- D. PS 20 - American Softwood Lumber Standard.

1.04 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

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

2.02 CONSTRUCTION PANELS

- A. Wall Sheathing: Plywood, PS 1, Grade C-D, Exposure I.

2.03 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
- B. General Purpose Construction Adhesives: Comply with ASTM C557.

PART 3 EXECUTION

3.01 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.

3.02 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 metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- E. Provide the following specific nonstructural framing and blocking:
 - 1. Wall brackets.
 - 2. Handrails.
 - 3. Grab bars.
 - 4. Towel and bath accessories.
 - 5. Wall-mounted door stops.

3.03 INSTALLATION OF CONSTRUCTION PANELS

- A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.

3.04 CLEANING

- A. Waste Disposal: See Section 01 74 19 - Construction Waste Management and Disposal.
 - 1. Comply with applicable regulations.
 - 2. Do not burn scrap on project site.
 - 3. Do not burn scraps that have been pressure treated.
 - 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior finish carpentry items.
- B. Wood casings and moldings.
- C. Hardware and attachment accessories.

1.02 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data:
 - 1. Provide manufacturer's product data, storage and handling instructions for factory-fabricated units.
 - 2. Provide data on fire retardant treatment materials and application instructions.
 - 3. Provide product data for operating hardware from storefront windows.
 - 4. Provide instructions for attachment hardware and finish hardware.
- C. Samples: Submit two samples of wood trim 18 inches long.

1.03 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum 5 years of experience.

1.04 REGULATORY REQUIREMENTS

- A. Conform to applicable code for fire retardant requirements.

1.05 PROJECT CONDITIONS

- A. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.
- B. Environmental Limitations:
 - 1. Conform to Architectural Woodwork Standards (AWS)/Quality Standards Illustrated (QSI) - Section 1700 - Installation of Woodwork.
 - 2. Install woodwork only when temperature and humidity conditions approximate interior conditions that will exist when building is occupied.
 - 3. Maintain temperatures and humidity in storage and installation areas as required to maintain moisture content of installed woodwork within a one-percent tolerance of the optimum moisture content determined by the fabricator; maintain required conditions through the remainder of the construction period.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Interior Woodwork Items:
 - 1. Moldings, Bases, Casings, and Miscellaneous Trim:
 - a. Solid wood, species to match existing interior moldings, bases, casings and trim.
 - 2. Window Frame:
 - a. Solid wood, species to match existing interior trim.

2.02 STANDING AND RUNNING TRIM MATERIALS

- A. Wood interior trim as scheduled
 - 1. Hardwood and/or Softwood solid lumber. Maximum moisture content of 6 percent.

2. Standard Mouldings and Base Mouldings: Species as indicated. Plain sawn, with flat grain of quality suitable for painted finish.
- B. Hardwood Lumber:
 1. Species and Grade: Match existing
 2. Moisture Content: 13 percent.
 3. Finger Jointing: Not allowed.
 4. Face Surface: Surfaced smooth.
 5. Matching: Selected for compatible grain and color.

2.03 SHEET MATERIALS

- A. MDF: Medium Density Fiberboard complying with ANSI/AHA A208.2, Class MD, no added formaldehyde.
 1. Acceptable Manufacturers:
 - a. Roseburg Forest Products; Medite II.
 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. MDF-X: Medium Density Fiberboard, Industrial Grade 155 MR50, complying with ANSI/AHA A208.2, passing ASTM D 1037, maximum moisture content 6 percent, formaldehyde-free; use as standing and running trim at wet and humid areas and at exterior openings for sills, aprons, jambs, and trim.
 1. Acceptable Manufacturers:
 - a. Roseburg Forest Products; Medex.
 2. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Softwood Plywood, Not Exposed to View: Any face species, veneer core; PS 1 Grade B-D, glue type as recommended for application.

2.04 FASTENINGS

- A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.
- B. Fasteners: Of size and type to suit application.
- C. Sealant: Of type to suit application, refer to Section 07 92 00.

2.05 ACCESSORIES

- A. Lumber for Shimming, Blocking, and Grounding: Softwood lumber of any species.
- B. Wood Filler: Solvent base, tinted to match surface finish color.

2.06 FABRICATION

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

2.07 FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. Apply wood filler in exposed nail and screw indentations.
- C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.
- D. Shop prime MDF and MDFX materials as indicated in Section 09 90 00.
- E. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
 1. Transparent:
 - a. System - 1, Lacquer, Nitrocellulose.

- b. Stain: To match existing.
- c. Sheen: To match existing.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that adequate backing and support framing has been solidly set and is ready for the work of this section.
- B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

- A. Set and secure materials and components in place, plumb and level.
- B. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.
- C. Intall in lengths as long as possible.
- D. Top of base to be level and align. Scribe to floor as required.
- E. Attachment of finish trim to walls indicated as acoustic:
 - 1. Verify and note walls that are framed using resilient channels to support gypsum board panels.
 - 2. **Do not** rigidly attach finish trim through resilient channels to framing members, only attach finish trim to resilient channels, contractor option to glue finish trim to gypsum board with approval by Architect.

3.03 PREPARATION FOR SITE FINISHING

- A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.
- B. Site Finishing: See Section 09 90 00.
- C. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.04 TOLERANCES

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

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Batt Insulation.
- B. Accessories.

1.02 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. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.03 QUALITY ASSURANCE

- A. Surface Burning Characteristics: For insulation and related materials UL/ULC Classified per UL 723 or meeting ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame spread index of 25 or less, and smoke developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame spread index of 75 or less, and smoke developed index of 150 or less.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the job site in original packages, containers, or bundles bearing the brand name and manufacturer's identification.
- B. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

1.05 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.01 BATT INSULATION MATERIALS

- A. Where batt insulation is indicated, either glass fiber, mineral fiber, or wool fiber batt insulation may be used, at Contractor's option, except where mineral fiber batt insulation is required to comply with fire rated assembly requirements. Insulations to be used shall be formaldehyde free.
- B. Thermal Insulation - Glass Fiber Batts: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
 - 1. Flame Spread Index: Class A; 25 or less, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index: Class A, 450 or less, when tested in accordance with ASTM E84.
 - 3. Combustibility: Non-combustible, when tested in accordance with ASTM E136.
 - 4. Formaldehyde Content: Zero.
 - 5. Thermal Resistance; tested at 75 degrees F, in accordance with ASTM C518.

6. Thickness: Varies, refer to Drawings.
7. Facing: Unfaced.
8. Products:
 - a. Basis of Design: Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: www.ocbuildingspec.com.
 - b. Other acceptable manufacturer's:
 - 1) CertainTeed Corporation: www.certainteed.com.
 - 2) Knauf Insulation, www.knaufinsulation.us
 - 3) Johns Manville: www.jm.com.
9. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Thermal Insulation - Mineral Fiber Batts: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced, formaldehyde free.
 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84 .
 2. Smoke Developed Index: Class A; 0 (zero), when tested in accordance with ASTM E84.
 3. Thickness: Varies, refer to Drawings.
 4. Density: Minimum 2 pcf
 5. Facing: Unfaced.
 6. Manufacturers:
 - a. ROCKWOOL (ROXUL, Inc); COMFORTBATT: www.rockwool.com/#sle.
 - b. Other acceptable manufacturer's:
 - 1) Thermafiber, Inc; Safing: www.thermafiber.com/#sle.
- D. Acoustical Insulation - Glass Fiber Batts: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
 1. Flame Spread Index: Class A; 25 or less, when tested in accordance with ASTM E84.
 2. Smoke Developed Index: Class A, 450 or less, when tested in accordance with ASTM E84.
 3. Combustibility: Non-combustible, when tested in accordance with ASTM E136.
 4. Acoustic assemblies: Provide specific products indicated in ESR report for acoustic assemblies indicated on Drawings.
 5. Formaldehyde Content: Zero.
 6. Thickness: Fill Cavity.
 7. Facing: Unfaced.
 8. Manufacturers:
 - a. Basis of Design: Owens Corning Corporation; EcoTouch Sound Attenuation Batts: www.ocbuildingspec.com.
 - b. Other acceptable manufacturer's:
 - 1) CertainTeed Corporation: www.certainteed.com.
 - 2) Knauf Insulation, www.knaufinsulation.us
 - 3) Johns Manville: www.jm.com.
 9. Substitutions: See Section 01 60 00 - Product Requirements.
 - E. Acoustic Insulation - Mineral Fiber Batts: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced, formaldehyde free.
 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
 2. Smoke Developed Index: Class A; 0 (zero), when tested in accordance with ASTM E84.
 3. Thickness: Fill Cavity.
 4. Density: Minimum 2.5 pcf
 5. Facing: Unfaced.
 6. Acoustic assemblies: Provide specific products indicated in ESR report for acoustic assemblies indicated on Drawings.
 7. Products:
 - a. Johns Manville; MinWool Sound Attenuation Fire Batts: www.jm.com/#sle.

b. Other acceptable manufacturer's:

1) ROCKWOOL (ROXUL, Inc); Safe 'n' Sound: www.rockwool.com/#sle.

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

2.02 ACCESSORIES

A. Insulating Foam Sealant:

1. HCFC-based, closed cell, spray applied polyurethane foam, ASTM C 1029.
2. Basis of Design: Great Stuff; Dow Building Solutions; www.dowbuildingsolutions.com.
3. Locations: For interstitial gaps of no more than approximately 1/2 inch.
 - a. Exterior door frame cavities.
 - b. Inside stud cavities surrounding openings.
 - c. Miscellaneous cavities and other locations indicated.

B. Wire supports for batts: Steel wire; electroplated or galvanized; type and size to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 BATT INSTALLATION

- A. Install insulation in accordance with manufacturer's instructions and not before the exterior sheathing has been installed on exterior side of the stud cavity. Joints in sheathing should be sealed to be water resistant prior to installing insulation.
- B. Fit batt insulation tightly into exterior wall steel stud cavity spaces and framing voids to create a continuous insulation layer without gaps. Trim to fill spaces and voids neatly. Fluff insulation to full thickness for specified R-value before installation. Do not compress insulation.
- C. Install in exterior wall spaces without gaps or voids. Do not compress insulation.
 1. Fluff insulation to full thickness for specified R-value before installation.
- D. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- E. Fit insulation tightly in cavities and tightly to exterior side of plumbing, mechanical and electrical services within the plane of the insulation.
- F. Unfaced batts:
 1. Tightly friction fit full width and depth of stud spacing with batt insulation, completely fill voids inside the stud cavity.
 2. Both sides of cavity shall be enclosed, if only one side is enclosed provide wire supports either continuous or heavy gage wire between studs to support batts.
- G. Batt insulation installed in floor cavities must be installed, such that batts are in full contact with subfloor sheathing.

3.03 INSTALLATION - ACCESSORIES

A. Insulating Foam Sealant:

1. Install insulating foam sealant in accordance with manufacturer's instructions.
2. Fill gaps surrounding openings and penetrations approximately 50 percent full.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

- B. Inspection: Insulating materials are to be installed such that the manufacturer's R-value mark is readily observable upon inspection.

3.05 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.
- B. Protect continuous insulation from contact with surfaces or temperatures in excess of 165 degrees F.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 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. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 4. Substrates the product should not be used on.
 - 5. Substrates for which use of primer is required.
 - 6. Substrates for which laboratory adhesion and/or compatibility testing is required.
 - 7. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
 - 8. Sample product warranty.
 - 9. Certification by manufacturer indicating that product complies with specification requirements.
- 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.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years experience and approved by manufacturer.
- C. Obtain sealant materials only from manufacturers who will, if required, send a qualified technical representative to work site, for the purpose of advising the installer of proper procedures and precautions for the use of the materials.

1.04 MOCK-UP

- A. Provide mock-up of Security Sealant.
 - 1. Locate where directed.
 - 2. Mock-up may remain as part of the Work.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to work site in original unopened containers or bundles with labels containing information about manufacturer, product name and designation, color, expiration period for use, pot life, curing time and mixing instructions for multi-component materials.

- B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with requirements of this section, within specified warranty period.
 - 1. Silicone Sealants: 20 years
 - 2. Urethane and Epoxy Sealants: 5 years.
- C. Installation Warranty:
 - 1. Correct defective workmanship for a period of five years after Date of Substantial Completion.
 - 2. Warranty covers defective workmanship of exterior sealants and accessories. Coverage includes failure to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.
 - 3. Repairs shall be made promptly, or materials replaced, after written notice at no additional cost to Owner.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers: Basis of design products indicated in Articles below.
 - 1. DOWSIL: www.consumer.dow.com.
 - 2. Master Builders Solutions by BASF: www.master-builders-solutions.basf.us.
 - 3. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com.
 - 4. Pecora Corporation: www.pecora.com.
 - 5. Sika Corporation: www.usa-sika.com.
 - 6. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.

2.02 JOINT SEALANTS - GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- B. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- C. Stain-Test-Response Characteristics: Provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- D. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- E. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168, refer to Section 01 60 00.
- F. Do not seal the following types of joints.
 - 1. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
 - 2. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
 - 3. Joints where installation of sealant is specified in another section.
 - 4. Joints between suspended panel ceilings/grid and walls.

2.03 SILICONE JOINT SEALANTS

- A. Type JS-1 - Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses NT, M, G, A and O; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus 100 percent, minus 50 percent , minimum.
 - 2. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.
 - 3. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
 - 4. Cure Type: Single-component, moisture curing .
 - 5. Basis of Design Product:
 - a. Tremco Global Sealants; Spectrem 1, Ultra Low-Modulus Silicone Joint Sealant; www.tremcosealants.com.
- B. Type JS-2 - Silicone Sealant: ASTM C920, Grade NS, Uses M, G, A and O; not expected to withstand continuous water immersion or traffic.
 - 1. Hardness Range: 35 to 40 , Shore A, when tested in accordance with ASTM C661.
 - 2. Cure Type: Single-component, neutral curing
 - 3. Basis of Design Product:
 - a. Tremco Global Sealants; Spectrem 2, High-Performance Silicone Sealant; www.tremcosealants.com.
- C. Type JS-3 - Silicone Sealant: ASTM C920, Grade T.
 - 1. Movement Capability: Plus 100 percent, minus 50 percent, minimum.
 - 2. Hardness Range: Minimum 15, Shore A, when tested in accordance with ASTM C661.
 - 3. Cure Type: Single-component, moisture curing
 - 4. Basis of Design Product:
 - a. Tremco Global Sealants; Spectrem 800/900SL, Low Modulus/Self Leveling Silicone Highway and Parking Structure Sealant; www.tremcosealants.com.

2.04 URETHANE JOINT SEALANTS

- A. Type JS-7 - Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single component.
 - 1. Movement Capability: +100 / -50 percent, minimum.
 - 2. Hardness Range: 40, Shore A, when tested in accordance with ASTM C661.
 - 3. Color: When sealant will be painted, select a manufacturer's standard sealant color that closely matches paint color to be applied, refer to Section 09 90 00 and Schedule of Finishes on Drawings.
 - 4. Basis of Design Product:
 - a. Tremco Global Sealants; Dymonic 100, High Performance, High Movement, Single Component, Polyurethane Sealant; www.tremcosealants.com.
- B. Type JS-8 - Nonsag "Traffic-Grade" Polyurethane Sealant: ASTM C920, Grade P, Uses T, M, A, O and I; single or multicomponent; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.
 - 1. Cure Type: Single-component, moisture curing
 - 2. Basis of Design Product:
 - a. Tremco Global Sealants; Vulkem 45SSL, Semi-self-leveling, Single-component, Moisture-curing, Low-modulus, polyurethane sealant; www.tremcosealants.com.

2.05 EPOXY JOINT SEALANTS

- A. Type JS-9 - Epoxy Sealant: ASTM C920, self-leveling. multicomponent 100 percent solids epoxy sealant.
 - 1. Hardness Range: 80 to 90 , Shore A, when tested in accordance with ASTM C661.
 - 2. Basis of Design Product:

- a. BASF Construction Chemicals - Building Systems; MasterSeal CR 190 (formerly Epolith-P); www.buildingsystems.basf.com.
- B. Type JS-13 - Epoxy Security Sealant: ASTM C920, self-leveling, multicomponent, rigid, two-part, high-solids, high modulus epoxy resin compound.
 - 1. Hardness Range: 70 , Shore A, when tested in accordance with ASTM C661.
 - 2. Compressive Strength: 11,000 psi, when tested in accordance with ASTM D695.
 - 3. Color: To be selected by Architect from manufacturer's standard range.
 - 4. Basis of Design Product:
 - a. Pecora Corporation; DynaPoxy EP-1200 Two-Part Epoxy Security Sealant: www.pecora.com.

2.06 LATEX JOINT SEALANTS

- A. Type JS-10 - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
 - 1. Color: Standard colors matching finished surfaces, Type OP (opaque).
 - 2. Grade: ASTM C834; Grade - NF.
 - 3. Basis of Design Product:
 - a. Tremco Global Sealants; Tremflex 834, Siliconized Interior Acrylic Latex Sealant; www.tremcosealants.com.
- B. Type JS-11 - Acoustic Sealant, Acrylic Emulsion Latex: Water-based; ASTM C834; single component, non-staining, non-bleeding, nonsag; not intended for exterior use.
 - 1. Color: Standard colors matching finished surfaces, Type OP (opaque).
 - 2. Grade: ASTM C834; Grade - Minus 18 Degrees C.
 - 3. Basis of Design Product:
 - a. USG Corporation; SHEETROCK Acoustical Sealant, www.usg.com
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.07 ACCESSORIES

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

2.08 FINISHES

- A. Colors: As indicated on Drawings.
- B. Maximum number of colors to be selected by Architect:
 - 1. Exterior: 5
 - 2. Interior: 5

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joints are ready to receive work.

- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.
- D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
 - 1. Notify Architect of date and time that tests will be performed, at least seven days in advance.
 - 2. Arrange for sealant manufacturer's technical representative to be present during tests.
 - 3. Record each test on Preinstallation Adhesion Test Log as indicated.
 - 4. If any sample fails, review products and installation procedures, consult manufacturer, or take other measures that are necessary to ensure adhesion; retest in a different location; if unable to obtain satisfactory adhesion, report to Architect.
 - 5. After completion of tests, remove remaining sample material and prepare joints for new sealant installation.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- C. 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.
- D. Do not proceed with installation of sealant over joint surfaces which have been painted, lacquered, waterproofed or treated with water repellent or other treatment or coating without sealant manufacturer's approval.

3.03 INSTALLATION

- A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Provide joint sealant installations complying with ASTM C1193.
- C. Install acoustical sealant application work in accordance with ASTM C919.
- D. Walls indicated as Acoustic:
 - 1. Acoustic sealants are effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies per ASTM E90.
 - 2. Verify that gypsum board installers have provided a 1/4 inch gap at perimeter of acoustic wall assemblies in accordance with Section 09 21 16.
 - 3. Install acoustic sealant (JS-11) in coordination with work covered under Section 09 21 16.
 - 4. Install full bead of acoustic sealant at perimeter of acoustic wall assemblies, including top and bottom of wall surface and sides of wall surface where intersecting adjacent wall surface..
 - 5. If joint between gypsum board panels exceeds 1/4 inch install backer rod prior to installation of acoustic sealant.
- E. Install bond breaker backing tape where backer rod cannot be used.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

- I. Do not allow sealants or compounds to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces including exposed aggregate panels and similar rough textures. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces, by either primer/sealer or the sealant compound.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Owner will employ an independent testing agency to perform the field quality control inspection and testing Agency to prepare and submit the field quality control plan and log, and to provide recommendations of remedies in the case of failure.
- C. Field Quality Control Testing:
 1. Visual inspection of entire length of sealant joints.
 2. Conduct Field-test for Adhesion for each type of exterior joint sealant to each joint substrate.
 - a. For each different sealant and substrate combination, allow for one test every 100 feet in the first 1000 linear feet, and one test per 1000 linear feet thereafter, or once per floor on each elevation.
 - b. If any failures occur in the first 1000 linear feet, continue testing at frequency of one test per 500 linear feet at no extra cost to Owner.
- D. Field Adhesion Test Procedures:
 1. Allow sealants to fully cure as recommended by manufacturer before testing.
 2. Arrange for initial testing to take place with joint sealant manufacturer's technical representative present.
 - a. Test Method: Test joint sealants according to Method A, Tail Procedure, in ASTM C1521.
 - b. For joints with dissimilar substrates, verify adhesion to each substrate separately..
 3. Have a copy of the test method document available during tests.
 4. 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.
 5. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
 6. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
 7. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.
 8. 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.
 9. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.
 - a. Sample: At least 18 inch long.
 - b. 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.
 - c. If either adhesive or cohesive failure occurs prior to minimum elongation, take necessary measures to correct conditions and re-test; record each modification to products or installation procedures.
- E. Field Adhesion Testing Log: Record testing data on Joint Sealant Adhesion Testing Log indicated in PART 1 under Preinstallation Field Adhesion Testing. Provide additional lines as required 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.

- F. Repair sealant joints, in accordance with manufacturer's instructions, upon completion of testing.
- G. Evaluation of Field-Test Results:
 - 1. Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory.
 - 2. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements.
 - 3. Retest failed applications until test results prove sealants comply with indicated requirements.
- H. Destructive Adhesion Testing: If there are any failures in first 1,000 linear feet, notify Architect immediately.

3.05 CURE AND PROTECTION

- A. Cure sealants and calking compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability. Do not cure in a manner which would significantly alter material's modulus of elasticity or other characteristics.
- B. Follow manufacturer's procedures required for curing and protection of sealants and calking compounds during construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at time of completion.

3.06 EXTERIOR JOINT SEALANT SCHEDULE

- A. Exterior Building Joints - Horizontal and vertical; non-traffic surfaces:
 - 1. Joint-Sealant Application (JS-1); exterior joints in vertical surfaces and horizontal nontraffic surfaces in the following locations:
 - a. Construction joints in cast-in-place concrete.
 - b. Perimeter joints between brick, terra-cotta trim units, and frames of windows, not scheduled to be painted; not requiring field painting.
 - c. Other joints as indicated.
- B. Exterior Building Joints - Horizontal; traffic surfaces:
 - 1. Joint-Sealant Application (JS-3) or (JS-8): Exterior joints in horizontal traffic surfaces .
 - 2. Joint Locations:
 - a. Isolation and contraction joints in cast-in-place concrete slabs.
 - b. Other joints as indicated.
- C. Exterior Joints - Vertical surfaces; non-traffic surfaces.
 - 1. Joint - Sealant Application (JS-2): Glazing system perimeter conditions.
 - a. Perimeter joints between brick, terra-cotta trim units, and frames of windows, not scheduled to be painted; not requiring field painting.
 - b. Other joints as indicated.
 - 2. Joint - Sealant Application (JS-7): Paintable.
 - a. Perimeter joints between brick, terra-cotta trim units, and frames of windows, not scheduled to be painted; not requiring field painting.

3.07 INTERIOR JOINT SEALANT SCHEDULE

- A. Interior Joints - Horizontal surfaces.
 - 1. Joint - Sealant Application (JS-8); pourable urethane sealant.
 - a. Joints in horizontal concrete surfaces.
 - 2. Joint Sealant Application (JS-9); horizontal traffic or non-traffic joints.
 - a. Joints in cast-in-place concrete slabs on grade.

- b. Other joints indicated.
- B. Interior Joints - Horizontal and vertical surfaces.
 - 1. Joint - Sealant Application (JS-2): Silicone Sealant.
 - a. Interior perimeter joints of exterior openings where painting of sealant is not required.
 - 2. Joint - Sealant Application (JS-7): Urethane Sealant.
 - a. Interior perimeter joints of exterior openings where painting of sealant is required.
 - 3. Joint - Sealant Application (JS-10); mildew-resistant latex sealant in the following locations in painted vertical and horizontal non-traffic surfaces:
 - a. Interior joints between plumbing fixtures and adjoining painted walls where sanitary joints are not required.
 - b. Joints where countertops, backsplashes, tile, intersect painted walls.
 - c. Control joints in gypsum board.
 - d. Pipe penetrations through painted surfaces.
 - 4. Joint Sealant Application (JS-11); vertical and horizontal non-traffic joints in acoustical assemblies.
 - a. Acoustical joints where indicated, air seal residential unit perimeter walls at floors and ceilings including demising walls, corridor walls, exterior walls, and walls in common with shafts, chases, and contiguous storage and miscellaneous rooms.
 - 1) Refer to Drawings.
 - b. Other joints indicated.
 - 5. Joint Sealant Application - Security Sealant (JS-13); vertical and horizontal non-traffic joints in the following locations:
 - a. Interior joints in holding rooms.
 - b. Pipe penetrations through painted surfaces in holding rooms.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flush hollow core prehung interior flush wood doors.
- B. Wood door frames.
- C. Wood casings.

1.02 RELATED REQUIREMENTS

- A. Section 06 20 00 - Finish Carpentry: For frames and casings.
- B. Section 08 7100 - Door Hardware: Other door hardware.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Obtain hardware templates from hardware supplier prior to starting fabrication.

1.04 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. Test Reports: Show compliance with specified criteria.
- D. Shop Drawings:
 - 1. Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, factory finishing criteria.
 - 2. Indicate wall conditions, door and frame elevations, sections, materials, gages, finishes, location of door hardware by dimension, and details of openings; use same reference numbers indicated on Drawings to identify details and openings.
- E. Samples: Provide finish samples for all products.
- F. Manufacturer's Installation Instructions: Provide manufacturer's written installation instructions. Indicate special installation instructions.
- G. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- H. Warranty, executed in Owner's name.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 01 60 00 Product Requirements.
- B. Deliver doors, materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Store doors as recommended by manufacturer.

1.06 WARRANTY

- A. Refer to Section 01 78 00 - Closeout Requirements for additional warranty requirements.
- B. Manufacturer standard warranty indicating that doors will be free from material and workmanship defects from the date of substantial completion for the time periods indicated below:
 - 1. Door System: 1 Year.

PART 2 PRODUCTS

2.01 DOORS

- A. Doors - General: Refer to drawings for locations and additional requirements.

- B. Quality Level: Custom Grade, Standard Duty performance, in accordance with AWI/AWMAC/WI (AWS).
- C. Door Style - Stile and Rail:
 - 1. Face Materials:
 - a. Veneer Species: Stain grade, White birch.
 - 1) Panel Pattern: Two panel(s).
 - 2) Panel Profile: Veneered Flat.
 - 3) Sticking Profile: Square.
 - 2. Door Core; Solid Core:
 - a. Solid Core Material: Particleboard Core meeting the requirements of ANSI 208.1, Grade LD-2
 - 3. Stiles and Rails:
 - a. Medium Density Fiberboard (MDF): ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
 - b. Softwood, finger joined, maximum moisture content of 6 percent..
 - c. Hardwood matching face veneer, maximum moisture content of 6 percent..
 - 4. Solid Wood Blocking: Softwood, finger joined, maximum moisture content of 6 percent..
 - a. Locations:
 - 1) Door Hardware locations for required hardware machining and for fastener attachments.
 - 5. Thickness: 1-3/8 inches.
- D. Door Frame:
 - 1. Profile: Solid hardwood; flat jambs with applied doorstop, double rabbet.
 - 2. Width: Refer to assembly sheet on Drawings
- E. Casing:
 - 1. Hardwood, species: []
 - 2. Paint grade, finger joined.
 - 3. Profile: Wedge Streamlined
- F. Hardware:
 - 1. Hinges: Manufacturer's standard; nickel plated (646).
 - 2. Lockset/passage set, refer to Section 08 71 00 - Door Hardware.

2.02 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
- C. Fabrication Method: Door facing to be bonded to stiles, rails, and core to form a 3 ply door.
- D. Provide solid blocks at lock edge for hardware reinforcement.
- E. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions. Obtain hardware templates from hardware supplier.
- F. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

2.03 FINISH

- A. Factory Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:
 - 1. Transparent:
 - a. System - 11, Polyurethane, Catalyzed.
 - b. Stain: Match existing adjacent wood veneer doors.
 - c. Sheen: Satin.

PART 3 EXECUTION

3.01 GENERAL

- A. Install doors in accordance with manufacturer's installation guidelines and recommendations.

3.02 EXAMINATION

- A. Inspect door prior to installation.
- B. Inspect rough opening for compliance with door manufacturer recommendations. Verify rough opening conditions are within recommended tolerances.

3.03 PREPARATION

- A. Prepare door for installation in accordance with manufacturer's recommendations.

3.04 INSTALLATION

- A. Place door unit into opening and level hinge side of jamb. Use shims fastened through jamb and stop to level and temporarily secure in place.
- B. Level latch side of jamb. Use shims fastened through jamb and stop to level and temporarily secure in place.
- C. Verify spacing between jamb and door is uniform on all sides. Adjust as necessary.
- D. Shim top of jamb in center of opening and secure with fastener.
- E. Re-check for square, level and even spacing around door. Nail securely in place through stop, jamb, shims and into studs every 12 inches.
- F. Set fasteners.
- G. Install trim on both sides using fasteners every 12 to 16 inches.

3.05 TOLERANCES

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

3.06 ADJUSTING

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

3.07 SCHEDULE - SEE DRAWINGS

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Detention security hollow metal doors and frames.
- B. Accessories, including glazing.

1.02 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, and finishes; and one copy of referenced standards/guidelines.
- C. Shop Drawings: Show layout and profiles; include assembly methods.
 - 1. Indicate product components, including hardware reinforcement locations and preparations, accessories, finish colors, patterns, and textures.
 - 2. Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- D. Schedule: Coordinated with other doors, frames, hardware, glazing, finishes and accessories.
- E. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
- F. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
- C. Maintain at project site copies of reference standards relating to installation of products specified.

1.04 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Detention Security Hollow Metal Doors and Frames:
 - 1. American Steel Products: www.amsteelpro.com.
 - 2. Sustainable Security Solutions: www.s3det.com.
 - 3. Sweeper Metal Fabricators: www.sweepermetal.com
 - 4. Titan Metal Products, Inc; Detention Rated Doors and Frames: www.titanmetalproducts.com.
 - 5. Trussbilt, LLC: www.trussbilt.com.
 - 6. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

- A. Detention Security Facility Door and Frame Assemblies: Comply with Grade 1 security characteristics, in accordance with NAAMM HMMA 863 and ASTM F1450 requirements.

- B. Accessibility: Comply with ICC A117.1 and ADA Standards.
- C. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

- A. Detention Security Doors; Interior:
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
 - b. Model 1 - Full Flush.
 - c. Door Face Metal Thickness: 12 gauge, 0.093 inch, minimum.
 - 2. Detention Security Facility Swinging Door Assemblies: Comply with Grade 1 security characteristics, in accordance with NAAMM HMMA 863 and ASTM F1450 requirements.
 - 3. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
 - 4. Door Thickness: As required to meet requirements indicated.
 - 5. Door Face Sheets: Flush.
 - 6. Door Finish: Factory finished.
 - 7. Door Edge Profile: Manufacturers standard for application indicated.
 - 8. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers standard.
 - 9. 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.
 - 10. Hinge Rail and Reinforcement: Non-beveled edge, reinforced with continuous steel channel, 12 gauge, 0.093 inch minimum metal thickness, welded at 5 inch on center maximum, and compatible with 4-1/2 inch full mortise template and continuous geared hinges.

2.04 HOLLOW METAL FRAMES

- A. Detention Security Door Frames, Interior: With same security resistance as door; face welded or full profile/continuously welded construction, ground smooth, fully prepared and reinforced for hardware installation.
 - 1. Frame Metal Thickness: 12 gauge, 0.093 inch, minimum.
 - 2. Frame Finish: Factory finished.

2.05 MATERIALS

- A. Steel Sheet: Comply with one or more of the following requirements:
 - 1. Galvannealed steel complying with ASTM A653.
 - 2. Cold-rolled steel complying with ASTM A1008.
 - 3. Hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011.
 - 4. Commercial steel (CS) Type B.

2.06 FINISHES

- A. Factory Finish: Complying with ANSI/SDI A250.3, manufacturer's standard coating.
 - 1. Color: As selected by Architect from manufacturer's standard range.

2.07 ACCESSORIES

- A. Detention Security Door Window Frames: Factory-glazed securely fastened within door opening.

1. Size: As indicated on Drawings..
 2. Frame Material: 10 gauge, 0.123 inch, galvanized steel.
 3. Finish: Factory Finished.
 4. Glazing: Provide in compliance with security grade requirements of door. Individual lites shall be permanently identified with a listing mark.
- 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. Do not prepare frames for silencers where weatherstripping or gasketing is indicated as applied to frame stop.
- D. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Install prefinished frames after painting and wall finishes are complete.
- C. Coordinate frame anchor placement with wall construction.
- D. 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.
- E. Coordinate installation of electrical connections to electrical hardware items.
- F. Touch up damaged factory finishes.

3.03 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.

3.04 ADJUSTING

- A. Adjust for smooth and balanced door movement.

3.05 SCHEDULE

- A. Refer to Door and Frame Schedule on Drawings.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Factory-fabricated wood windows.
- B. Glazing.
- C. Operating hardware.
- D. Wood trim for exterior finishing.

1.02 RELATED REQUIREMENTS

- A. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.
- B. Section 08 80 00 - Glazing.
- C. Section 09 91 23 - Interior Painting: Site finishing wood surfaces.
- D. Section 09 93 00 - Staining and Transparent Finishing: Site finishing wood surfaces.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Show component dimensions, anchorage and fasteners, glass, internal drainage details, and [_____].
- C. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related work, installation requirements, and [_____].
- D. Operating Hardware: Two samples of each type of operating hardware.

1.04 DELIVERY, STORAGE, AND HANDLING

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

1.05 FIELD CONDITIONS

1.06 WARRANTY

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Wood Windows:
 - 1. Jeld-Wen; <https://www.jeld-wen.com>.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 WOOD WINDOWS

- A. Wood Windows: Wood frame and sash, factory fabricated and assembled.
 - 1. Exterior Finish: Unfinished, for opaque finish.
 - 2. Interior Finish: Unfinished, for transparent finish.
 - 3. Color: As indicated on drawings.
 - 4. Configuration: As indicated on drawings.
 - 5. Transparent Finish: Scarf joints permitted if wood matches in color and grain texture.
 - 6. Fasteners: Concealed from view.

2.03 COMPONENTS

- A. Glazing: Double glazed, clear, Low-E coated, argon filled, with glass thicknesses as recommended by manufacturer for specified wind conditions. Glazing shall meet current energy codes and also replicate the color and visible light transmittance of existing glass in

the existing historic windows.

- B. Frames: Match existing historic window frames as closely as possible.
- C. Operable Sash Weatherstripping: Wool pile; permanently resilient, profiled to effect weather seal.
- D. Fasteners: Stainless steel.
- E. Sealant and Backing Materials: See Section 07 92 00 of types as indicated.
- F. Flashing: Provide related flashings, with necessary anchors and attachment devices.

2.04 HARDWARE

- A. Sash lock: Lever handle with cam lock.

2.05 ALUMINUM FINISHES

- A. Aluminum jamb liner
 - 1. Provide manufacturer's standard aluminum jamb liner as indicated in drawings.
 - 2. Jamb liner shall be prepared to accept painted finish in the field.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install windows in accordance with manufacturer's instructions.
- B. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.
- C. Install operating hardware.
- D. Finish exterior surfaces with opaque materials; see Section 09 93 00.
- E. Finish interior surfaces with transparent materials; see Section 09 93 00.

3.02 FIELD QUALITY CONTROL

- A. Provide services of wood window manufacturer's field representative to observe for proper installation of system and submit report.

3.03 ADJUSTING

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

3.04 CLEANING

- A. Remove protective material from factory finished surfaces.
- B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Bullet-resistant security transaction windows with bullet-resistant glazing and pass-through device

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Furnish anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, to be embedded into concrete or masonry, with setting diagrams and installation, to applicable installer in time for installation.
- B. Preinstallation Meeting: Prior to start of installation arrange a meeting on site to familiarize installer and installers of related work with requirements relating to this work.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's published data showing materials, construction details, dimensions of components, and finishes.
- C. Shop Drawings: Drawings prepared specifically for this project, showing plans, elevations, sections, details of construction, anchorage to other work, hardware, and glazing.
 - 1. Show required opening dimensions and allowance for field deviation.
 - 2. For field glazed windows, include detailed instructions for glazing installation.
- D. Test Reports: Test reports for specific window model and glazing to be furnished, showing compliance with specified requirements; window and glazing may be tested separately, provided window test sample adequately simulates the glazing to be used.
 - 1. Include testing agency qualifications.
 - 2. For structural, forced entry, and ballistic tests, provide details on method of anchorage to test frame.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firm with at least 5 years experience in the manufacture of windows of the type specified.
- B. Testing Agency Qualifications: Independent testing agency able to show experience in conducting tests of the type specified and:

1.05 DELIVERY, STORAGE, AND HANDLING

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

1.06 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.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Provide manufacturer's warranty agreeing to repair or replace windows and window components that fail within 1 years after Date of Substantial Completion due to, but not limited to, the following:
 - 1. Structural failure, failure of welds, and deterioration of metals and finishes beyond that expected under detention use and normal weathering.

2. Failure of glazing due to excessive deflection of supporting members under wind load.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design Security Transaction Windows with Pass-Through Device:
 - 1. Amortex; WI-TW-HM-SW: www.amortex.com
- B. Other acceptable Manufacturers; pending conformance to Basis of Design requirements:
 - 1. Diebold, Inc:
 - 2. Ross Engineering
 - 3. Norshield Security Products

2.02 PERFORMANCE CRITERIA

- A. Transaction Window Performance:
 - 1. Design and construct transaction window in a manner that provides a completely assembled, finished unit with a dip tray and shelf, to be installed in a finished opening.
 - 2. Natural voice frame must be UL Listed Level 4 and provide for two way "natural voice" communication permitted by the design of the vertical side frames and glazing technique..
 - 3. Glazing to be UL Listed Level 4
 - 4. All welds shall be in accordance with the requirements and standard practices of the American Welding Society. All exposed welds shall be ground flush and finished smooth.

2.03 ASSEMBLIES

- A. Security and Detention Windows:
 - 1. Dimensions, profiles, features, and performance specified and indicated on drawings are required; do not deviate unless specifically approved by Architect.
 - 2. Design to fit openings indicated on drawings; design to accommodate deviation of actual construction from dimensions indicated on drawings.
 - 3. Fabricate frames and sash with corners mitered or coped full depth with concealed welded joints.
 - 4. Design anchorages to provide performance equivalent to that required for window unit; provide anchorages at least equivalent to those by which the tested units were anchored to the test frame.
 - 5. Separate dissimilar metals to prevent corrosion by galvanic action by painting contact surfaces with primer or with sealant or tape recommended by manufacturer for the purpose.
 - 6. Weld components before finishing and in concealed locations, to greatest extent possible; minimize distortion and discoloration of finish; remove residue of welding; grind exposed welds smooth and finish to match.
 - 7. Label units to indicate which side is which, such as inside/outside or secure/non-secure; use labels that are removable after installation but durable enough not to be lost during delivery, storage, handling, and installation.
- B. Security transaction window with transparent package receiver.
 - 1. Frame:
 - a. The vertical side of frames to be manufactured of 12 gauge steel, prime painted and drilled in at least four points on each side to permit the anchoring to structural members or mullion with an adjoining unit.
 - b. Hole placement shall prohibit the removal of these anchoring or attaching devices from the opposite side of glazing.
 - c. Top and bottom edges of the glazing to be capped with no less than 20 gauge stainless steel, with a # 3 finish.
 - d. Frame design shall not be of hollow metal-like design.
 - e. Aluminum frames are not acceptable.

2. Glazing: Protection level specified and must be UL Listed Laminated Glass.
3. Shelf: Provide a shelf not less than 2 inch thick with a recessed deal tray. The shelf to be full width of window and a minimum of 12 inches deep centered under glazing.
 - a. Finish: Solid core stainless steel no less than 18 gauge with a # 3 finish
4. Deal Tray:
 - a. Material: Constructed of minimum 16 gauge stainless steel, # 3 finish

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that window openings are ready for installation of windows.
- B. Notify Architect if conditions are not suitable for installation of windows; do not proceed until conditions are satisfactory.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions and drawing details.
- B. Install windows in correct orientation (inside/outside or secure/non-secure).
- C. Anchor windows securely in manner so as to achieve performance specified.
- D. Set sill members and sill flashing in continuous bead of sealant.

3.03 ADJUSTING

- A. Adjust operating components for smooth operation while also providing tight fit at contact points and a secure enclosure; lubricate operating hardware.

3.04 CLEANING

- A. Clean exposed surfaces promptly after installation without damaging finishes.
- B. Remove and replace defective work.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hardware for hollow metal and wood doors.
- B. Electrically operated and controlled hardware.
- C. Cylinders for door hardware specified in other sections.
- D. Weatherstripping, seals and door gasketing.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.
- B. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.
- C. Keying Requirements Meeting:
 - 1. Attendance Required:
 - a. Contractor.
 - b. Owner.
 - c. Hardware Installer.
 - 2. Agenda:
 - a. Establish keying requirements.
 - b. Verify locksets and locking hardware are functionally correct for project requirements.
 - c. Verify that keying and programming complies with project requirements.
 - d. Establish keying submittal schedule and update requirements.
 - 3. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
 - a. Access control requirements.
 - b. Key control system requirements.
 - c. Schematic diagram of preliminary key system.
 - 4. Record minutes and distribute to attendees in accordance with Section 01 30 00.
 - 5. Record minutes and distribute copies within two days after meeting to participants, with [] copies to Architect, Owner, participants, and those affected by decisions made.
 - 6. Deliver established keying requirements to manufacturers.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data:
 - 1. Manufacturer's edited catalog literature for each type of hardware, marked to clearly show products and accessories to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.
 - 2. Submit manufacturer's parts lists, templates and installation instructions indicating special procedures and perimeter conditions requiring special attention.
- C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as indicated in Contract Documents.
 - 1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
 - 2. Comply with DHI (H&S) using door numbers and hardware set numbers as indicated as indicated in Hardware Schedule at end of this section and on Drawings.
 - 3. Hardware schedule is intended for coordination of the Work. Review and acceptance by the Architect does not relieve the Contractor of his exclusive responsibility to fulfill the

requirements as shown and specified.

4. List groups and suffixes in proper sequence.
5. Provide complete hardware description for each door listed. Use door numbering scheme as included on Drawings. Identify electrically operated items and include power requirements.
6. Provide manufacturer name, product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
7. Indicate locations and mounting heights of each type of hardware.
8. Include listing of abbreviations and symbols used in schedule.
9. Door Hardware Schedule Format: Based on door hardware indicated, organize hardware schedule into "Hardware Sets" or "Hardware Groups". Comply with the following format:

Hardware Set No. 8 (sample)

1-1/2 PAIR	BUTTS	5BB1 4.5 X 4.5	652
1	LOCK SET	ND70PD RHODES	626
1	CLOSER	LCN-4111	689
1	KICKPLATE	8400 10 X 34 B4E	630
1	WALL STOP	WS407CCV	630
3	SILENCERS	SR64	GRAY

- a. Hardware schedules prepared in the horizontal manner are not acceptable. Doors listed for the same hardware, but of different sizes shall be listed under separate headings.
- D. Shop Drawings - Electrified Door Hardware: Submit diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
1. Prepared by or under supervision of Architectural Hardware Consultant (AHC) or Electrified Hardware Consultant (EHC).
 2. Elevations: Submit front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
 3. Diagrams: Submit point-to-point wiring diagram that shows each device in door opening system with related colored wire connections to each device.
- E. Keying Schedule:
1. Submit 3 copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.
- F. Contract Closeout Documents:
1. Submit under provisions of Section 01 70 00 - Execution and Closeout Requirements.
 2. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
 - a. Submit manufacturer's parts lists and templates.
 - b. Bitting List: List of combinations as furnished.
 3. Keying Schedule: Submit final keying schedule for inclusion in closeout documents.
 4. Keys: Deliver with identifying tags to Owner by security shipment direct from hardware supplier.
 5. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
 - a. Factory order numbers and dates shall be provided to the Owner for warranty purposes.
 6. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.

7. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
 - a. See Section 01 60 00 - Product Requirements, for additional provisions.
 - b. Extra Lock Cylinders: 10 for each master keyed group.
 - c. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

1.04 QUALITY ASSURANCE

- A. Preparation of hardware schedule is intended for coordination of the Work. Review and acceptance by the Architect does not relieve the Contractor of his exclusive responsibility to fulfill the requirements as shown and specified.
- B. Perform the Work in accordance with the following standards:
 1. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design
 2. ICC A117.1 - Accessible and Usable Buildings and Facilities.
 3. NFPA 80 - Standards for Fire Doors and Other Opening Protectives
 4. NFPA 101 - Life Safety Code.
 5. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.
 6. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.
- C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum 5 3 years of experience.
- D. Hardware Supplier Qualifications:
 1. Company specializing in performing work of the type specified for commercial door hardware with at least 3 years of experience.
 2. Hardware Supplier shall employ an Architectural Hardware Consultant (AHC) to assist in the work of this section and shall be available, at reasonable times during the course of the work, for consultation about project's hardware requirements, to Owner, Architect and Contractor.
 3. Supplier shall have warehousing facilities.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.
- B. Hardware Supplier shall deliver hardware to the project site; direct factory shipments are not allowed unless agreed upon beforehand. Hardware supplier shall coordinate delivery times and schedules with the contractor.
- C. Inventory door hardware jointly with representatives of hardware supplier and hardware installer/contractor until each is satisfied that count is correct.
- D. Storage:
 1. Provide secure lock-up for door hardware delivered to the Project, but not yet installed.
 2. Control handling and installation of hardware items that are not immediately replaceable so that completion of work will not be delayed by hardware losses both before and after installation.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
 1. Structural failures including excessive deflection, cracking, or breakage.
 2. Faulty operation of operators and door hardware.
 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

- C. Warranty against defects in material and workmanship for 2 years from Date of Substantial Completion, unless noted otherwise below.
1. Manual Closers:
 - a. Heavy Duty: 30 years
 2. Exit Devices: 3 years
 3. Locksets and Latchsets:
 - a. Commercial Grade; ANSI/BHMA Grade 1:
 - 1) Mortise Locks: 3 years
 4. Cylinders: 3 years
 5. Electrical Security Products and Electrical Closers: 1 year.

PART 2 PRODUCTS

2.01 MANUFACTURERS - BASIS OF DESIGN

- A. Door hardware of equivalent quality, size, type, finish, and function to that specified will be considered as an acceptable substitution. Requested substitutions must be submitted for approval prior to bid date as indicated in Section 01 60 00.
- B. Substitutions, submit prior to bid date: Refer to Section 01 60 00 - Product Requirements.

	Description	Specified Manufacturers	Acceptable Substitute Manufacturers
1.	Hinges	Ives (IVE)	Stanley, McKinney
4.	Latches and Locksets - Mortise	Schlage (SCH)	None
9.	Surface Closers - Heavy Duty 4010/4110 Series	LCN (LCN)	None
14.	Exit Devices	VonDuprin (VON)	None
18.	Protection Plates	Ives (IVE)	Trimco, Tice
19.	Thresholds and Weatherstripping	Zero (ZER)	Pemko, National Guard (NGP)
20.	Power Transfers	VonDuprin (VOD)	None
22.	Power Supplies	Schlage Electronics (SCE)	None

2.02 HARDWARE DESIGN AND PERFORMANCE

- A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.
- B. Hand of Door: Drawings show direction of slide, swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
- C. Manufacturer's Name Plate: Manufacturer's identification will be permitted on rim of lock cylinders only or on edges of door.
- D. Function: Lock and latch function numbers and descriptions of manufactures series as listed in hardware schedule.
- E. Provide individual items of single type, of same model, and by same manufacturer.
- F. Provide door hardware products that comply with the following requirements:
1. Applicable provisions of federal, state, and local codes.
 2. Accessibility: ADA Standards and ICC A117.1.
 3. Applicable provisions of NFPA 101.

4. Fire-Rated Openings: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
5. Hardware on Fire-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for application indicated.
 - a. Where emergency exit devices are required on fire-rated doors (with supplementary marking on doors' UL or FM labels indicating "Fire Door to be Equipped with Fire Exit Hardware"), provide UL or FM label on exit devices indicating "Fire Exit Hardware".
6. Hardware for Smoke and Draft Control Doors (Indicated as "S" on Drawings): Provide door hardware that complies with local codes, and requirements of assemblies tested in accordance with UL 1784.
7. Listed and certified compliant with specified standards by BHMA (CPD).
8. Auxiliary Hardware: BHMA A156.16.
9. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
10. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
11. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.
- G. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.
- H. Fasteners:
 1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
 - a. **Aluminum** fasteners are not permitted.
 - b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
 2. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
 3. Fire-Rated Applications: Comply with NFPA 80.
 - a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
 - b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

2.03 HINGES/BUTTS

- A. Hinges - Basis of Design: As indicated in Hardware Sets.
- B. Hinges: Complying with BHMA A156.1, Grade 2, unless noted otherwise in Hardware Schedule.
 1. Templates: Except for hinges installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
 2. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
 - a. Provide hinge width required to clear surrounding trim.
 3. Provide hinges on every swinging door.
 - a. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
 - b. Provide ball-bearing hinges at each door with closer.
 - c. Provide non-removable pins on exterior outswinging doors.
 - d. Provide non-removable pins on interior outswinging doors at locations as indicated.
 - e. Provide power transfer hinges where electrified hardware is mounted in door leaf.
 4. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - a. Steel Hinges: Steel pins.
 - b. Non-ferrous Hinges: Stainless steel pins.

- c. Exterior Doors: Non-removable pins.
- d. Interior Doors: Non-rising pins.
- e. Tips: Flat button and matching plug, finished to match leaves.
- 5. Provide following quantity of butt hinges for each door:
 - a. Doors From 60 inches High up to 90 inches High: 3 hinges.
 - b. Doors 90 inches High up to 120 inches High: 4 hinges.
 - c. Doors over 120 inches High: One additional hinge per each additional 30 inches in height.

2.04 EXIT HARDWARE/PANIC HARDWARE

- A. Exit Hardware/Panic Hardware- Basis of Design: As indicated in Hardware Sets.
- B. Exit Hardware/Panic Hardware: Comply with BHMA A156.3, Grade 1.
 - 1. Lever design to match lockset trim.
 - 2. Provide cylinder with cylinder dogging or locking trim.
 - 3. Provide exit hardware/panic hardware properly sized for door width and height.
 - 4. Provide strike as recommended by manufacturer for application indicated.
 - 5. Provide UL (DIR) listed exit hardware/panic hardware assemblies for fire-rated doors and panic device assemblies for non-fire-rated doors.
 - 6. Exposed parts of exit hardware/panic hardware shall be of the metal and finish specified herein.
 - 7. Furnish with provisions for concealed mounting. Through-bolts are not acceptable unless required by fire codes or fire tests.
 - 8. Exit hardware/panic hardware to be used on Class A, B, C, D or E labeled doors and shall be Underwriters' Laboratories listed exit devices. Dogging features shall be omitted and latches shall have 3/4-inch deadlocking latchbolt.
 - 9. Where cylinder operation is called for in the hardware sets, the cylinders shall be keyed as agreed upon in the keying schedule.
 - 10. Exit hardware/panic hardware shall have a cast/flush end cap. No overlapping edges are allowed.

2.05 LOCK CYLINDERS

- A. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
 - 1. Basis of Design: Schlage Everest keyway (verify keyway with Owner).
 - 2. Provide standard and full size interchangeable core (FSIC) type cylinders, Grade 1, with six-pin core in compliance with BHMA A156.5 at locations indicated.
 - 3. Provide cylinders from same manufacturer as locking device.
 - 4. Provide cams and/or tailpieces as required for locking devices.

2.06 LOCKSETS AND LATCHSETS - GENERAL

- A. Locks: Provide a lock for every door, unless specifically indicated as not requiring locking.
 - 1. Hardware Sets indicate locking functions required for each door.
 - 2. If no hardware set is indicated for a swinging door provide an entry type lockset.
 - 3. Trim: Provide lever handle or pull trim on key side of locks unless specifically stated to have no trim on secure side of door.
 - 4. Lock Cylinders: Provide key access on secure side of lockset unless specifically stated to have no locking or no trim on secure side.
- B. Latchbolts and deadlocking latchbolts:
 - 1. Provide deadlocking latchbolts on locksets.
 - 2. Provide minimum 5/8-inch throw latchbolt throw and minimum 1 inch deadbolt throw. Comply with UL requirements for throw of bolts and latchbolts on rated fire openings.
 - 3. Provide minimum 1/2-inch throw on other latch and deadlock bolts.
 - 4. Rabbeted Doors: Where rabbeted door stiles are indicated, provide special rabbeted latchbolts.

2.07 MORTISE LOCKSETS AND LATCHSETS

- A. Mortise Locksets and Latchsets - Basis of Design: As indicated in Hardware Sets.
- B. Mortise Locks: Comply with BHMA A156.13, Grade 1, Security, 1000 Series.
 - 1. Latchbolt Throw: 3/4 inch, minimum.
 - 2. Deadbolt Throw: 1 inch, minimum.
 - 3. Backset: 2-3/4 inch unless otherwise indicated.
 - 4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
 - a. Finish: To match lock or latch.
 - 5. Unisex toilet rooms and bathing rooms: Provide locks with integral visible occupancy indicators. Unit must be equipped with ADA compliant thumbturn and have simultaneous retraction of latchbolt and deadbolt when inside lever is turned.

2.08 CLOSERS

- A. Closers - Basis of Design: As indicated in Hardware Sets.
- B. Closers: Complying with BHMA A156.4.
 - 1. Type: Surface mounted to door.
 - 2. Provide door closer on each exterior door.
 - 3. Where an overlapping astragal is included on pairs of swinging doors, provide coordinator to ensure door leaves close in proper order.
 - 4. Unit operations:
 - a. Except as otherwise specifically indicated, comply with the manufacturer's recommendations for size of door control unit, depending upon size of door, exposure to weather and anticipated frequency of use.
 - b. Closer Arms:
 - 1) Provide forged arms for closers for both regular and parallel style arms.
 - 2) Provide parallel arms for overhead closers, except as otherwise indicated.
 - 3) Provide spring cushion type arms, not dead stop, where closer must be used to stop doors.
 - 4) Locate closer to accommodate maximum degree of opening permitted.
 - c. Closer back-check valves are not to be used as a stop for doors.
 - d. Pressure relief valves are not permitted.
 - 5. Barrier-Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped, provide adjustable units complying with ICC A117.1 provisions for door opening force and delayed action closing.

2.09 PROTECTION PLATES

- A. Protection Plates - Basis of Design: As indicated in Hardware Sets.
- B. Protection Plates: Comply with BHMA A156.6.
 - 1. Unless otherwise specified or required, kickplates shall be 10 inches high, mop plates 6 inches high and armor plates 30 inches high, and the length shall be 2 inches less door width at single doors and 1 inch less door width of pairs of doors.
 - a. Provide UL label on armor plates indicated to be placed on fire-rated door assemblies.
 - 2. Install protection plates with oval-head full-thread screws spaced uniformly at a maximum of 5 inches and to match the kickplate.
 - 3. Kickplate at handicapped (designated) doors shall be minimum 12 inches high to meet Federal, State and local requirements.
- C. Metal Properties: Stainless steel.
 - 1. Metal, Heavy Duty: Thickness 0.062 inch, minimum.
- D. Edges: Beveled, on four sides unless otherwise indicated.

E. Fasteners: Countersunk screw fasteners.

2.10 DOOR SILENCERS

A. Door silencers:

1. Provide rubber door silencers for door frames at openings having single-acting doors in wood or metal frames. Do not provide silencers on frames with adhesive applied gasketing on frame stop.
2. Provide 3 silencers for single doors and 4 silencers for each pair of doors.

2.11 FLOOR STOPS

A. Stops - Basis of Design: As indicated in Hardware Sets.

B. Floor Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.

1. Type: Dome floor stop unless indicated otherwise in hardware schedule at end of section.
2. Material: Plated brass or bronze base metal housing with rubber insert.
3. Stop is not required if positive stop feature is specified for door closer; positive stop feature of door closer is not an acceptable substitute for a stop unless specifically so stated.

2.12 WALL STOPS

A. Stops - Basis of Design: As indicated in Hardware Sets.

B. Wall Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.

1. Provide wall stops, unless otherwise indicated.
2. Type: Bumper, concave, wall stop.
3. Material: Plated steel housing with rubber insert.
4. If wall stops are not practical, due to configuration of room or furnishings, provide overhead stop.
5. Stop is not required if positive stop feature is specified for door closer; positive stop feature of door closer is not an acceptable substitute for a stop unless specifically so stated.

2.13 WEATHERSTRIPPING AND GASKETING

A. Weatherstripping and Gasketing: Comply with BHMA A156.22.

1. Head and Jamb Type: Encased in retainer or adhesive type.
2. Door Sweep Type: Encased in retainer.
3. Material: Aluminum, with santoprene weatherstripping.
4. Provide gasketing for smoke and draft control doors (Indicated as "S" on Drawings) that complies with local codes, requirements of assemblies tested in accordance with UL 1784.
5. Exterior Doors:
 - a. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.
 - 1) Where exterior door is also required to have fire or smoke rating, provide gaskets functioning as both smoke and weather seals.
6. Provide sound-rated gasketing and automatic door bottom (if so indicated in hardware schedule) on doors indicated as "Sound-Rated", "Acoustical", or with "Sound Transmission Class (STC) rating"; fabricate as continuous gasketing, do not cut or notch gasketing material.

B. Drip Guard: Provide projecting drip guard over exterior doors unless they are under a projecting roof or canopy.

2.14 SILENCERS

- A. Silencers: Provide at equal locations on door frame to mute sound of door's impact upon closing.
 - 1. Single Door: Provide three on strike jamb of frame.
 - 2. Pair of Doors: Provide two on head of frame, one for each door at latch side.
 - 3. Material: Rubber, gray color.

2.15 FINISHES

- A. Finishes: Provide door hardware of same finish, as indicated in Hardware Groups, unless otherwise indicated.
 - 1. Finish: As indicated in hardware schedule at end of section
 - 2. Exceptions:
 - a. Where base material metal is specified to be different, provide finish that is an equivalent appearance in accordance with BHMA A156.18.
 - b. Hinges for Fire-Rated Doors: Steel base material with plated finish, in compliance with NFPA 80.
 - c. Door Closer Covers and Arms: Color as selected by Architect from manufacturer's standard colors unless otherwise indicated.
 - d. Aluminum Surface Trim and Gasket Housings: Anodized to match door panel finish, not other hardware, unless otherwise indicated.

PART 3 EXECUTION

- A. Verify that electric power is available to power operated devices and of correct characteristics.

3.02 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and applicable codes.
- B. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.
- C. Install hardware for smoke and draft control doors in accordance with NFPA 105.
- D. Use templates provided by hardware item manufacturer.
- E. Where cutting and fitting is necessary to install hardware, which is later to be painted or finished in another way, install each item completely and then remove and store in a secure place during the finish application. After completion of the finishes, reinstall each item. Do not install surface-mounted items until finishes have been completed.
- F. Closers: Adjust backcheck valve and closing speed valve immediately after closer is installed on door to prevent slamming or racking of door. Re-adjust backcheck valve and closing speed after mechanical systems have been adjusted and balanced prior to Final Completion.
- G. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
 - 1. Locksets: 38 inches.
 - 2. Push/Pulls: 42 inches from finish floor to center of plate. Cut for cylinder where required..
 - 3. Dead Locks: 48 inches.
 - 4. Exit Devices: 40 inches, unless indicated otherwise by manufacturer.
 - 5. Other hardware shall be installed as recommended by manufacturer.
- H. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel

countersunk screws.

3.03 FIELD QUALITY CONTROL

- A. Perform field inspection and testing under provisions of Section 01 40 00 - Quality Requirements.
- B. Provide an Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

3.04 ADJUSTING

- A. Adjust work under provisions of Section 01 70 00 - Execution and Closeout Requirements.
- B. Adjust hardware for smooth operation.
- C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.
- D. Lubricate moving parts with type of lubrication recommended by manufacturer (silicone-type spray if no other recommended.)
- E. Replace units which cannot be adjusted and lubricated to operate freely and smoothly as intended for the application made.
- F. Replace units which cannot be adjusted and lubricated to operate freely and smoothly as intended for the application made.

3.05 CLEANING

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

3.06 PROTECTION

- A. Protect finished Work under provisions of Section 01 70 00 - Execution and Closeout Requirements.
- B. Do not permit adjacent work to damage hardware or finish.

3.07 SCHEDULE

HARDWARE GROUP NO. 01

40 50 60

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1		HARDWARE BY DOOR MANUFACTURER		

HARDWARE GROUP NO. 02

100

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:











QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3 EA	HINGE	5BB1HW 4.5 X 4.5 NRP	606	IVE
1 EA	POWER TRANSFER	EPT10 CON	695	VON
1 EA	DBL EU MORTISE LOCK	L9095TEU 17N CON 12/24 VDC	606	SCH
2 EA	FINAL CORE	23-030 (COORDINATE KEY SYSTEM MANUF. WITH OWNER)	606	SCH
1 EA	SURFACE CLOSER	4011	696	LCN
1 EA	KICK PLATE	8400 10" X 2" LDW B-CS	606	IVE
1 EA	WALL STOP	WS406/407CVX	606	IVE
1 EA	GASKETING	488SBK PSA (FOR SOUND)	BK	ZER
1 EA	WIRE HARNESS	CON-44P		SCH
1 EA	WIRE HARNESS	CON-6W (FROM EPT TO INCOMING POWER)		SCH
2		ACCESS CONTROL BY OTHERS		

THIS DOOR IS CONTROLLED ON BOTH SIDES.

HARDWARE GROUP NO. 03

117

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:








QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		606	IVE
1	EA	POWER TRANSFER	EPT10 CON	 ⚡	695	VON
1	EA	EU MORTISE LOCK	L9092TEU 17N RX CON 12/24 VDC	 ⚡	606	SCH
1	EA	FINAL CORE	23-030 (COORDINATE KEY SYSTEM MANUF. WITH OWNER)		606	SCH
1	EA	SURFACE CLOSER	4011		696	LCN
5	EA	TRANSMITTER	8310-861	 ⚡		LCN
1	EA	RECEIVER	8310-865	 ⚡		LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		606	IVE
1	EA	WALL STOP	WS406/407CVX		606	IVE
1	EA	WIRE HARNESS	CON-44P	⚡		SCH
1	EA	WIRE HARNESS	CON-6W (FROM EPT TO INCOMING POWER)	⚡		SCH
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC	 ⚡		VON
1			ACCESS CONTROL BY OTHERS			
1		WIRING DIAGRAMS	PROVIDE RISER AND POINT TO POINT DIAGRAMS			

POWER SUPPLY REQUIRES 120VAC. POWER SUPPLY TO OPERATE THE REMOVE RECEIVER AND UNLOCK THE LOCKSET WHEN A TRANSMITTER IS PRESSED.

HARDWARE GROUP NO. 04

168






PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		606	IVE
1	EA	PANIC HARDWARE	LD-98-L-NL-17		606	VON
1	EA	RIM CYLINDER	20-057 ICX (COORDINATE KEY SYSTEM MANUF. WITH OWNER)		606	SCH
1	EA	FINAL CORE	23-030 (COORDINATE KEY SYSTEM MANUF. WITH OWNER)		606	SCH
1	EA	CLOSER W/STOP ARM	4111 SCUSH WMS		696	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		606	IVE
1	EA	GASKETING	488SBK PSA (FOR SOUND)		BK	ZER

HARDWARE GROUP NO. 05

185









PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		606	IVE
1	EA	OFFICE W/SIM RETRACT	L9056T 17N 09-544		606	SCH
1	EA	FINAL CORE	23-030 (COORDINATE KEY SYSTEM MANUF. WITH OWNER)		606	SCH
1	EA	WALL STOP	WS406/407CVX		606	IVE
1	EA	GASKETING	488SBK PSA (FOR SOUND)		BK	ZER

HARDWARE GROUP NO. 06

1432


PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		606	IVE
1	EA	PANIC HARDWARE	98-L-17		606	VON
1	EA	RIM CYLINDER	20-057 ICX (COORDINATE KEY SYSTEM MANUF. WITH OWNER)		606	SCH
1	EA	FINAL CORE	23-030 (COORDINATE KEY SYSTEM MANUF. WITH OWNER)		606	SCH
1	EA	SURFACE CLOSER	4111 EDA WMS		696	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		606	IVE
1	EA	WALL STOP	WS406/407CVX		606	IVE
1	EA	GASKETING	488SBK PSA (FOR SOUND)		BK	ZER

HARDWARE GROUP NO. 07

E100

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:






QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	TRIM	990-EO		US19	VON
			BALANCE OF HARDWARE EXISTING			

VERIFY EXISTING FINISH BEFORE ORDERING. REMOVE EXISTING 990NL PULL AND REPLACE WITH BLANK-OUT EXIT ONLY PLATE. THIS IS THE EXISTING EXTERIOR PAIR AT THE MAIN ENTRY.

HARDWARE GROUP NO. 08

160

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		606	IVE
1	EA	PANIC HARDWARE	LD-98-L-BE-17		606	VON
1	EA	CLOSER W/STOP ARM	4111 SCUSH WMS		696	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		606	IVE
1	EA	GASKETING	488SBK PSA (FOR SOUND)		BK	ZER

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Monolithic glass units
- B. Glazing films.
- C. Glazing compounds.

1.02 ADMINISTRATIVE REQUIREMENTS

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

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Delegated Design Submittal:
 - 1. Refer to Section 01 35 73 for additional delegated design requirements.
 - 2. Engineer glazing assemblies to withstand deadloading, and impact loading (where applicable), without failure.
- C. Product Data on Monolithic Glass Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- D. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- E. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
 - 1. Safety Glazing: Identify all locations where required.
- F. Samples:
 - 1. Submit two samples 12 by 12 inch in size of glass units.
 - 2. Submit sealant color chart for selection from manufacturer's available colors by Architect.
 - 3. Submit 8 inch long bead of glazing sealant, selected colors.
- G. Manufacturer's Certificate: Certify that products of this section meet or exceed specified requirements.
- H. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- I. Submit Installers qualifications.

1.04 QUALITY ASSURANCE

- A. Engineer Qualifications: Design glazing components in accordance with Performance Criteria and under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.
- B. Perform Work in accordance with GANA (GM), GANA (SM), and GANA (LGRM) for glazing installation methods. Maintain one copy on site.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of experience.
- D. Insulating Glass Certification Program: Provide insulating glass units permanently marked either on spacers or at one component pane of units with appropriate certification label of inspecting and testing organization indicated below:
 - 1. Insulating Glass Certification Council (IGCC): Provide CBA rating compliance certification.

2. Associated Laboratories, Inc. (ALI).
- E. IGU Fabricator: Company whose location, equipment, and processes are certified by the coated glass manufacturer.
- F. Installer Qualifications: Company specializing in performing work of the type specified and with at least 3 years experience.
 1. A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

1.05 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.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period.
 1. Defects include peeling, cracking, and other indications of deterioration of coating.
 2. Warranty Period: A minimum of ten (10) years from date of Substantial Completion.
- C. Insulating Glass Units: Provide manufacturer's standard warranty to include coverage for seal failure, interpane dusting or misting, deterioration of coatings. Deterioration of coated glass is defined as peeling, cracking, or related defects developed from normal use that are not associated with breakage or with actions in violation of written guidance from the manufacturer. Warranty shall include replacement of failed units.
 1. Warranty Period: Provide a ten (10) year manufacturer warranty.
- D. Laminated Glass Units: Provide manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by ASTM C 1172 Standard Specification for Laminated Architectural Flat Glass.
 1. Warranty Period: Provide a five (5) year manufacturer warranty.
- E. Polycarbonate Sheet Glazing: Provide a five (5) year manufacturer warranty to include coverage for breakage, coating failure, abrasion resistance, including providing products to replace failed units.
- F. Heat Soaked Tempered Glass: Provide a five (5) year manufacturer warranty to include coverage for spontaneous breakage of fully tempered glass caused by nickel sulfide (NiS) inclusions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Float Glass Manufacturers:
 1. Cardinal Glass Industries: www.cardinalcorp.com.
 2. Guardian Industries Corp.: www.sunguardglass.com.
 3. Oldcastle Building Envelope: www.obe.com.
 4. Pilkington North America Inc.: www.pilkington.com/na.
 5. Vitro Architectural Glass.: www.vitroglazings.com/en-us/.

- B. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Fabricators:
 - 1. Any of the manufacturers specified for float glass.
 - 2. Any fabricator certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.

2.02 PERFORMANCE CRITERIA

- 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.
 - 2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
 - 3. Seismic Loads: Design and size glazing components to withstand seismic loads and sway displacement in accordance with the requirements of ASCE 7, and as adopted by applicable building codes.
 - 4. 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.
 - 5. Glass thicknesses listed are minimum.
- B. 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 6.3 computer program.
 - 2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 - 3. Solar Optical Properties: Comply with NFRC 300 test method.
- C. Impact Resistant Safety Glazing Requirements: Provide safety glazing materials at hazardous locations required by applicable building code for project.

2.03 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
 - 1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
 - 2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
 - 3. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
 - 4. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
 - 5. Impact Resistant Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 criteria; Class A/Category II.
- B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
 - 1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.
 - 2. Polyvinyl Butyral (PVB) Interlayer: 0.030 inch thick, minimum.

2.04 MONOLITHIC GLASS UNITS

- A. Monolithic Safety Glazing (GL-2): Non-fire-rated.
 - 1. Applications:
 - a. Glazed lites in doors, except fire doors.
 - b. Glazed sidelights to doors, except in fire-rated walls and partitions.
 - c. Other locations required by applicable federal, state, and local codes and regulations.
 - d. Other locations indicated on drawings.
 - 2. Glass Type: Fully tempered safety glass as specified.

3. Tint: Clear[_____].
4. Thickness: 1/4 inch, minimum.
- B. Laminated Glazing (GL-3): Laminated glass, 2-Ply.
 1. Applications: Locations as indicated on drawings.
 2. Tint: Clear[_____].
 3. Thickness: 1/2 inch, minimum.
 4. Outer Lite: Tempered glass.
 5. Interlayer: Polyvinyl butyral (PVB), thickness as required to meet performance criteria.
 6. Inside Lite: Tempered glass.

2.05 GLAZING FILMS

- A. Decorative Plastic Film (GF-1): Vinyl type.
 1. Application: Locations as indicated on drawings.
 2. Series Type: Manufactured by 3M; "Fasara - SH2MAML Milky White".
 3. Width: As required for area to be covered.

2.06 GLAZING COMPOUNDS

- A. Sealant: Refer to Section 07 92 00 - Joint Sealants.

2.07 ACCESSORIES

- A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot 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 Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.02 PREPARATION

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

3.03 INSTALLATION, GENERAL

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- C. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing,

plastering, mortar droppings, etc.

3.04 INSTALLATION - DRY GLAZING METHOD (TAPE AND TAPE)

- A. Application - Interior Glazed: Set glazing infills from the interior of the building.
- B. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sight line.

3.05 INSTALLATION - GLAZING FILM

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

3.06 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.
- C. Monitor and report installation procedures and unacceptable conditions.

3.07 CLEANING

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

3.08 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

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Moisture and alkalinity testing of existing and new concrete floor substrates identified in the contract documents to receive the following types of floor coverings:
 - 1. Carpet tile.
- B. Application of remedial floor coating; to mitigate the following should conditions exist:
 - 1. To resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits.
 - 2. Resist high levels of alkalinity (pH).
 - 3. Remedial floor coating shall be compatible with floor covering adhesive without further treatment.
- C. Preparation of new and existing concrete floor slabs for installation of floor coverings.
- D. Remedial floor coatings.

1.02 SUBMITTALS

- A. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
 - 1. Moisture and alkalinity (pH) limits and test methods.
 - 2. Manufacturer's required bond/compatibility test procedure.
- B. Field Quality-Control Submittals:
 - 1. Testing Agency's Report which includes the following:
 - a. Description of areas tested; include floor plans and photographs with the following indicated:
 - 1) Date of testing.
 - 2) Type of test performed.
 - 3) Graphic location of each test.
 - 4) Results of each test cross-referenced to the floor plan.
 - b. Summary of conditions encountered.
 - c. Moisture and alkalinity (pH) test reports.
 - d. Copies of specified test methods.
 - e. Recommendations for remediation of unsatisfactory surfaces.
 - 2. Submit report directly to Owner and Architect.
 - 3. Submit report not more than two business days after conclusion of testing.

1.03 QUALITY ASSURANCE

- A. Moisture and alkalinity (pH) testing will be performed by an independent testing agency employed and paid by Owner.
- B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
 - 1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.
 - 2. Submit qualifications per ASTM E329
- 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. Coordinate with testing agency number of days required on site for testing activities.
 - 4. Achieve and maintain specified ambient conditions.

5. Notify Architect when specified ambient conditions have been achieved and when testing will start.

D. Qualifications:

1. Remedial Coating Manufacturer: Company specializing in manufacturing products specified with minimum 5 years experience.
2. Remedial Coating Installer: Company specializing in performing work of the type specified, and trained by or employed by coating manufacturer.

1.04 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.

1.05 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.
- C. Do not deliver or install the Remedial Floor Coating until wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Slabs with Moisture Vapor Reducing Admixture (MVRA): Provide warranty to cover the cost of flooring failures due to moisture migration from slabs for ten years.
 1. Include cost of repair or removal of failed flooring, placement of topical moisture remediation system, and replacement of flooring with comparable flooring system.
 2. Provide warranty by manufacturer of MVRA matching terms of flooring adhesive or primer manufacturer's material defect warranty.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Single-Source Responsibility:
 1. Provide products from one manufacturer.
 2. Products provided under this section shall be from the same manufacturer as products provided under Section 03 54 00 - Cast Underlayment.
- B. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
 1. Thickness: 1/8 inch, maximum.
 2. Products:
 - a. Basis of Design: ARDEX Engineered Cements; ARDEX MC RAPID: www.ardexamericas.com.
 - b. Koster American Corporation: www.kosterusa.com.

C. Accessories:

1. Fill-and-Bond Coat: Portland-cement-based compound complying with ASTM D695 for uneven substrates and adhesion prior to the installation of a moisture-control system.
 - a. Acceptable Product: Ardex MRP.
2. Pipe Boots: As recommended by coating manufacturer.
3. Crack Sealer: Semi-rigid epoxy crack filler as recommended by coating manufacturer.

PART 3 EXECUTION

3.01 EXECUTION

- A. Examine substrate areas and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 CONCRETE SLAB PREPARATION

- A. Perform following operations in the order indicated:
 1. Preliminary cleaning.
 2. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 3. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 4. Specified remediation, if required.
 5. Patching, smoothing, and leveling, as required.
 6. Other preparation specified.
 7. Adhesive bond and compatibility test.
 8. Protection.

3.03 FIELD QUALITY CONTROL

- A. Internal Relative Humidity Testing:
 1. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
 2. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
 3. Test in accordance with ASTM F2170 Procedure A and as follows.
 - a. 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.
 4. 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.
 5. Report: Report the information required by the test method.
- B. Alkalinity Testing:
 1. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
 2. 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.
- C. Record data and results and submit report in accordance with Section 01 30 00.

3.04 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.
 - 1. Allow the fill-and-bond coat to dry for 24 hours prior to proceeding with the installation of the Remedial Floor Coating.
 - 2. Do not fill expansion joints, isolation joints, or other moving joints.
- D. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with fill-and-bond coat.
- E. Concrete substrate shall be structurally sound, solid, and mechanically prepared to a minimum surface profile of ICRI CSP #3 (light shotblast).
 - 1. Acid-etching and the use of sweeping compounds and solvents will not be acceptable means of preparing the concrete.
 - 2. Where the mechanical preparation has resulted in a surface profile that is CSP #6 or higher, the use of specified fill coat is recommended to pre-smooth the concrete prior to installing the Remedial Floor Coating.

3.05 JOINT AND CRACK PREPARATION

- A. Repair cracks in the subfloor to minimize telegraphing through the underlayment.
 - 1. Moving Joints: Honor expansion and isolation joints up through the Remedial Floor Coating, and underlayment or topping
 - 2. Non-Moving Joints: Properly fill all saw cuts, control joints and dormant cracks greater than 1/32 inch with products approved by coating manufacturer.
- B. Allow areas to cure for a minimum of 16 hours prior to proceeding.

3.06 APPLICATION OF REMEDIAL FLOOR COATING

- A. Install the Remedial Floor Coating. Comply with requirements and recommendations of coating manufacturer.
- B. Install cementitious leveling underlayment specified in Section 03 54 00 - Cast Underlayment over Remedial Floor Coating. Cast underlayment must be from same manufacturer as remedial floor coating.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Metal framing for interior partitions, ceilings and soffits.
- C. Metal suspension systems.
- D. Resilient sound isolation components.
- E. Gypsum sheathing.
- F. Gypsum board.
- G. Delegated design of interior non-loadbearing metal framing and seismic bracing of ceiling suspension system .

1.02 DEFINITIONS

- A. Building Envelope Dry-in: Point in construction when the building shell has been completed sufficiently to keep out wind, rain, snow, or weather in general, thus assuring that weather-sensitive materials or work can begin indoors without materials suffering damage by weather conditions and wood framed Inspection Report has been submitted.
- B. Steel Thickness: Minimum base metal thickness per SSMA.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate application of Vapor Barrier/Gypsum Board Primer, provided under Section 09 90 00, to interior surfaces of gypsum board applied to exterior walls.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Delegated Design Submittal:
 - 1. Refer Section 01 35 73 - Delegated Design to or additional delegated design requirements.
 - 2. Provide metal framing material thickness based on Performance Criteria indicated below and manufacturer's printed span tables.
 - 3. Engineer suspended ceiling assemblies to withstand the affects of seismic movement on ceiling suspension system.
- C. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
- D. Product Data: Provide data on metal framing, gypsum board, accessories, and gypsum board surface finish .
- E. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- F. Gypsum Board Product Schedule: Include each generic finish material and the gypsum board type appropriate for use and finish condition. Refer to gypsum board types indicated in Part 2 article "Board Materials"
- G. Inspection Report: Prior to installation of gypsum board submit report of moisture content readings taken of wood framing members per requirements indicated under Article entitled "Examination". Include summary at the beginning of the report by floor indicating if the wood framing members on each floor met or did not meet the moisture requirement by "Pass" or "Fail". Following the summary include specific information including date of moisture content reading, moisture content of member, location of reading and type of wood framing member.

1.05 QUALITY ASSURANCE

- A. Engineer Qualifications: Provide engineering services under direct supervision of a Professional Engineer experienced in design of this Work and licensed at the State in which the Project is located.
- B. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 5 years of experience.
- C. Perform in accordance with ASTM C 754, ASTM C 840. Comply with requirements of GA-600 for fire-rated assemblies. Comply with more stringent recommendations of Northwest Wall and Ceiling Bureau (NWCB).
- D. Provide acoustically rated assemblies in compliance with listings for ratings indicated.

1.06 REGULATORY REQUIREMENTS

- A. Conform to applicable code for fire rated assemblies as indicated on drawings.
- B. Brace and restrain ceilings as required by building code and AHJ.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store gypsum board in accordance with GA-801.
- B. Package and handle to prevent damage during shipping and unloading.
- C. Deliver materials to site in manufacturer's original unopened containers with brand name and product type clearly marked.
- D. Store materials inside and protected from damage by weather and direct sunlight. Stack flat; protect ends, edges, and faces of gypsum boards from damage. Protect metal accessories from moisture.

1.08 FIELD CONDITIONS

- A. Do not begin installation of gypsum board products until Building Envelope Dry-in, Inspection Report is submitted verifying moisture content of wood framing members are within acceptable levels indicated, area is conditioned at Temperature Range for a minimum of 48 hours prior to beginning installation, and Temperature Range is maintained for the remainder of the project.
 - 1. Temperature Range: Between 50 and 95 degrees F.
 - 2. Exception: Moisture-resistant Glass Mat Gypsum Board is the only gypsum board material allowed to be installed prior to Building Envelope Dry-in.

PART 2 PRODUCTS

2.01 PERFORMANCE CRITERIA - GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
 - 1. See PART 3 for finishing requirements.
- B. Interior Partitions:
 - 1. Partition Head To Structure Connections:
 - a. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members.
 - b. Provide mechanical anchorage devices that accommodate deflection while maintaining the fire-rating of the wall assembly.
 - 2. Non-Loadbearing Framing System Components: ASTM C 645; galvanized sheet steel, of size and properties necessary to comply with ASTM C 754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.

- a. Exception: Partitions scheduled to receive tiled surfaces; L/360 at 5 psf.
- b. Exception: Partitions scheduled to receive stone tile or stone veneer: L/720 at 5 psf.
3. Partitions for seismic support: Engineer interior partitions to withstand the effects of seismic motions when indicated to support the following:
 - a. Architectural casework, and similar items mounted to walls and weighing more than 20 pounds.
 - b. Freestanding and wall supported shelving and similar items taller than 6 feet.
4. Partitions, Indicated as Sound-Rated: Provide completed assemblies with the following characteristics:
 - a. Acoustic Attenuation: STC of value indicated on Drawings calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

2.02 METAL FRAMING MATERIALS

- A. Manufacturers - Metal Framing, Connectors, and Accessories; subject to compliance with requirements, provide cold-formed metal framing by one of the following:
 1. ClarkDietrich: www.clarkdietrich.com/#sle.
 2. Dietrich Metal Framing: www.dietrichindustries.com.
 3. Marino: www.marinoware.com/#sle.
 4. SCAFCO Corporation: www.scafco.com/#sle.
 5. Steeler Inc.: www.steeler.com
 6. The Steel Network, Inc.; www.steelnetwork.com.
- B. Non-structural Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing as specified under Performance Criteria Article above.
 1. Runners: U shaped, sized to match studs.
 2. Ceiling Channels: C-shaped.
 3. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch.
 4. Furring Members: U-shaped sections, minimum depth of 3/4 inch.
 5. Furring Members: Zee-shaped sections, minimum depth of 1 inch.
- C. Deflection Track; provide one of the following assemblies:
 1. 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.
 2. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection and prevent rotation of studs while maintaining structural performance of partition.
 - a. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
 - b. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot-dipped galvanized coating.
 - c. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-resistance rating of the wall assembly.
 3. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 12 feet.
 4. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems indicated on drawings.
- D. Non-structural Framing Accessories:
 1. 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: Refer to Drawings

- c. Products:
 - 1) ClarkDietrich; Pony Wall (PW): www.clarkdietrich.com.
 - 2) Substitutions: See Section 01 60 00 - Product Requirements.
- E. Auxiliary Framing Components:
 - 1. Furring: Hat-shaped sections, minimum depth of 7/8 inch or as indicated.
 - 2. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width required to support construction.
 - a. Length: As required to support construction. As a minimum, extend strap one additional stud beyond required length.
 - b. Minimum Width: 6 inches.
 - c. Minimum Base-Metal Thickness: 54 mil (16 gage).
 - 3. Protective Coating: Coating with equivalent corrosion resistance of ASTM A653/A653M, G40 (Z120), hot-dip galvanized, unless otherwise indicated.
 - 4. Products:
 - a. Same manufacturer as other framing materials.

2.03 PRE-ENGINEERED METAL SUSPENSION SYSTEMS

- A. Non-Loadbearing Suspension System: Cold-rolled steel, hot dipped galvanized finish, of size and properties necessary, as engineered by manufacturer, to support gypsum board with maximum deflection limits of ceiling framing system of L/240 per ASTM C636. System consisting of straight main tees along with straight cross tees, that join together to support screw-attached gypsum panels, with independently supported light fixtures, and air diffusers, as applicable to design.
- B. Seismic Design Requirements: Provide ceilings designed and installed to withstand the effects of earthquake motions according to the following:
 - 1. IBC Seismic Design Category for Project Site: As indicated on Drawings.
 - 2. Alternate methods approved by authority having jurisdiction (AHJ).
 - 3. Edge Molding Design: Face of molding less than 1 inch wide when using concealed seismic clip.
 - 4. Provide rigidly braced system.
- C. System Components:
 - 1. Main Tees: Heavy Duty classification, with integral reversible splice.
 - a. Fire-rated where indicated, with knurled face.
 - 2. Cross Members:
 - a. Cross Tees: Quick release cross tee ends for positive locking and removability without tools.
 - b. Fire-Rated members shall have knurled face.
 - c. Wall moldings: Single web channel or angle with knurled face.
 - 3. Accessories:
 - a. Provide transition clips, splice clips, wall attachment clips, splice plates, dome hubs, drywall clips, zinc alloy corner reinforcements (minimum 26 gage), zinc alloy casing reinforcement (minimum 24 gage), zinc alloy control joints (minimum 26 gage) and other components as may be required for a complete system.
 - b. Perimeter Moldings: Formed galvanized steel trim with integral flange for finishing drywall.
 - 4. Fasteners: Conventional Gypsum Panel fasteners (ASTM C1002). No. 6 Type-S, HiLo bugle head, self-drilling, self-tapping steel screws.
 - 5. Exterior suspension systems: Provide components with G90 hot-dipped galvanized coating.

2.04 SOUND ISOLATION COMPONENTS

- A. Resilient Channels (RC Channel): Furring channel installed perpendicular to framing members through bottom leg only.
 - 1. Product: ClarkDietrich Building Systems; RC Deluxe Resilient Channel (RCSD): www.clarkdietrich.com. No substitutions.
 - 2. Material: Grade 33ksi minimum yield strength, G40 galvanized, 0.022 inch (22 mil) minimum thickness.
 - 3. Dimensions: 2-5/8 inch wide by 1/2 inch deep with a 1-1/2 inch screw flange
 - 4. Stock Lengths: 12 feet.
- B. Wall and Ceiling Acoustic Isolation Clips:
 - 1. Basis of Design; Manufacturer: PAC International, Inc.; www.pac-intl.com.
 - a. Other acceptable manufacturers:
 - 1) Kinetics Noise Control, Inc.; "IsoMax"; www.kineticsnoise.com
 - 2) Pliteq, Inc.; "GenieClip"; www.pliteq.com
 - 2. Isolation Clips: Resilient Sound Isolation Clip.
 - a. Product: RSIC-1
 - b. Rubber Isolator: Natural organic rubber compound, blended with fire-inhibiting compounds. Molded to isolate ferrule from clip. Manufactured to ASTM D 2000, M2 AA 510 A13, which includes:
 - 1) Hardness, ASTM D 2240, Shore A: 47.
 - 2) Modulus 300 Percent, ASTM D 412, Die C: 5.3 MPa.
 - 3) Tensile Strength, ASTM D 412, Die C: 11.2 MPa.
 - 4) Elongation at Break, ASTM D 573: 454 percent.
 - c. Ceiling Clip: Galvanized or aluminum-zinc coated steel, 16 gauge.
 - d. Ferrule: Zinc-electroplated steel.
 - e. Projection: 1-5/8 inches from supporting structure, when 7/8-inch drywall furring channels are used.
 - f. Mechanical Fasteners: As recommended by manufacturer.
 - 3. Isolation Clips: Resilient Sound Isolation Backer.
 - a. Products:
 - 1) RSIC-1 Backer
 - b. Rubber Isolator: Natural organic rubber compound, blended with fire-inhibiting compounds. Molded to isolate ferrule from clip. Minimum of 12 micro-vibration controlling pedestals at point of contact with framing member. Manufactured to ASTM D 2000, M2 AA 510 A13, which includes:
 - 1) Hardness, ASTM D 2240, Shore A: 47.
 - 2) Modulus 300 Percent, ASTM D 412, Die C: 5.3 MPa.
 - 3) Tensile Strength, ASTM D 412, Die C: 11.2 MPa.
 - 4) Elongation at Break, ASTM D 573: 454 percent.
 - c. Load Capacity: 216 pounds.
 - d. Ferrule: Zinc-electroplated steel.
 - e. Projection: 1-5/8 inch from supporting structure.
 - f. Mechanical Fasteners: As recommended by manufacturer.
 - 4. Isolation Clips: Resilient Sound Isolation DeCouple Clip.
 - a. Product: RSIC-DC04 Sound Isolation Clip Series
 - b. Rubber Isolator: Natural organic rubber compound, blended with fire-inhibiting compounds. Molded to isolate ferrule from clip. Minimum of 12 micro-vibration controlling pedestals at point of contact with framing member. Manufactured to ASTM D 2000, M2 AA 510 A13, which includes:
 - 1) Hardness, ASTM D 2240, Shore A: 47.
 - 2) Modulus 300 Percent, ASTM D 412, Die C: 5.3 MPa.
 - 3) Tensile Strength, ASTM D 412, Die C: 11.2 MPa.

- 4) Elongation at Break, ASTM D 573: 454 percent.
- c. Load Capacity: 72 pounds per clip.
- d. Ferrule: Zinc-electroplated steel.
- e. Mechanical Fasteners: As recommended by manufacturer.
- C. Mechanical Fasteners: As required by manufacturer.
- D. Acoustic Insulation: As specified in Section 07 21 00.
- E. Acoustic Sealant: As specified in Section 07 92 00.
- F. Electrical Box Putty Pads: Non-hardening endothermic compound designed to seal around electrical boxes to reduce sound transmission and protect against the spread of fire, smoke and toxic gasses.
 - 1. Basis of Design: Specified Technologies, Inc.; SpecSeal Series SSP putty pads; www.stifirestop.com
 - a. Other acceptable manufacturers:
 - 1) Hilti North America; www.hilti.com
 - 2) 3M Fire Protection Products; www.solutions.3m.com
 - 3) Kinetics Noise Control, Inc.; www.kineticsnoise.com
 - 4) Lowry's, Inc; www.halowry.com
 - 2. Density: 12.08 pounds per gallon
 - 3. Solids: 100 percent.
 - 4. UL listed.

2.05 BOARD MATERIALS

- A. Gypsum Board Manufacturers:
 - 1. CertainTeed Corporation: www.certainteed.com/#sle.
 - 2. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
 - 3. Lafarge North America Inc: www.lafargenorthamerica.com.
 - 4. National Gypsum Company: www.nationalgypsum.com/#sle.
 - 5. PABCO Gypsum: www.pabco gypsum.com/#sle.
 - 6. USG Corporation: www.usg.com/#sle.
- B. Gypsum board - General:
 - 1. Single-Source Responsibility: Obtain gypsum board products from one source and from one single manufacturer. In the event a single manufacturer can not provide all products indicated obtain written approval from primary manufacturer that products are compatible.
 - 2. Comply with minimum flame spread index/smoke-developed index: 25/450 maximum, when tested in conformance with requirements of ASTM E 84.
 - 3. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
 - 4. Provide gypsum board panels in sizes to minimize joints in place; provide ends square cut.
- C. Gypsum Board:
 - 1. Thickness:
 - a. Vertical Surfaces: 5/8 inch, unless required otherwise by assembly.
 - b. Ceilings: 5/8 inch, unless required otherwise by assembly.
 - c. Type C Thickness: 5/8 inch, unless required otherwise by assembly.
 - d. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
 - 2. Paper-Faced Gypsum Board: Panels as defined in ASTM C1396/C1396M.
 - a. Basis of Design Products:
 - 1) Georgia-Pacific Gypsum; ToughRock: www.gpgypsum.com/#sle.
 - 2) Georgia-Pacific Gypsum; ToughRock Fireguard X: www.gpgypsum.com/#sle.
 - 3) Georgia-Pacific Gypsum; ToughRock Fireguard C: www.gpgypsum.com/#sle.
 - 3. Abuse Resistant Wallboard:

- a. Application: Holding Rooms.
- b. Surface Abrasion: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
- c. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
- d. Soft Body Impact: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
- e. Hard Body Impact: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
- f. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
- g. Thickness: 5/8 inch.
- h. Edges: Tapered.

2.06 GYPSUM BOARD ACCESSORIES

- A. Acoustical Insulation - Glass Fiber Batts: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
 1. Flame Spread Index: Class A; 25 or less, when tested in accordance with ASTM E84.
 2. Smoke Developed Index: Class A, 450 or less, when tested in accordance with ASTM E84.
 3. Acoustic assemblies: Provide specific products indicated in ESR report for acoustic assemblies indicated on Drawings.
 4. Formaldehyde Content: Zero.
 5. Thickness: Fill Cavity.
 6. Facing: Unfaced.
 7. Manufacturers:
 - a. Basis of Design: Owens Corning Corporation; EcoTouch Sound Attenuation Batts: www.ocbuildingspec.com.
 - b. Other acceptable manufacturer's:
 - 1) CertainTeed Corporation: www.certainteed.com.
 - 2) Knauf Insulation, www.knaufinsulation.us
 - 3) Johns Manville: www.jm.com.
 8. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Finishing Accessories: ASTM C1047, galvanized steel sheet ASTM A924/A924M G90 or rolled zinc, unless noted otherwise.
 1. Types: As detailed or required for finished appearance.
 2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.
 3. Products:
 - a. Same manufacturer as framing materials.
- C. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
 1. Fiberglass Tape: 2 inch wide, coated glass fiber tape for joints and corners in wet areas.
 2. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
 3. Joint Compound - Typical: Drying type, vinyl-based, ready-mixed.
- D. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.
- E. 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.
- F. Nails for Attachment to Wood Members: ASTM C514.

- G. Screws: ASTM C 1002; self-piercing tapping type, anticorrosive-coated at wet areas.
- H. 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

3.01 EXAMINATION

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

3.02 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
 - 1. Level ceiling system to a tolerance of 1/1200.
 - 2. Laterally brace entire suspension system.
 - 3. Install bracing as required at exterior locations to resist wind uplift.
- C. Studs: Space studs at 16 inches on center, unless indicated otherwise.
 - 1. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.
 - 2. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
 - 3. Extend partition framing to structure unless noted otherwise .
 - 4. Partitions Terminating at Structure: Use one of the following methods of attaching studs to structure.
 - a. 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.
 - b. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
- D. Provide not less than 43 mil thick studs supporting wall cabinets and similar high wall loads. Refer to casework specification for design load.
- E. Provide not less than 54 mil thick studs supporting plumbing fixtures, counter tops and similar low wall-hanging loads. In addition to dead load, support 300 pound live load located anywhere on supported item.
- F. Install horizontal bridging in studs, spaced in rows indicated on Shop Drawings but not more than 54 inches apart. Fasten at each stud intersection.
 - 1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 18 inches of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - a. Install solid blocking at 48 inches on center and at wall ends.
 - 2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 - 3. Bridging: Combination of 1-1/2 inch by 0.0329 inch flat, taut, steel sheet straps and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
- G. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

- H. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
 - 1. Orientation: Horizontal.
 - 2. Spacing: As indicated.
- I. Acoustic Furring: Install resilient channels at maximum 24 inches on center. Locate joints over framing members.
- J. Resilient Sound Isolation Clips: Install resilient sound isolation clips, and where applicable, associated furring sections and channels, in accordance with clip manufacturer's written instructions.
- K. Blocking: Install mechanically fastened flat strap or steel blocking plate for support of:
 - 1. Wall-mounted cabinets.
 - 2. Plumbing fixtures.
 - 3. Toilet accessories.
 - 4. Wall-mounted door hardware.

3.03 SOUND ISOLATION COMPONENT INSTALLATION

- A. Resilient Channels: Install resilient channels at maximum 24 inches on center when framing members are spaced at 16 inches on center, unless indicated otherwise.
 - 1. Install resilient channels in accordance with manufacturer's instructions.
 - 2. Locate joints over framing members. Where two resilient channels meet at framing member, provide 1/16 inch gap between channel flanges and attached each channel to the framing member.
 - 3. The direction of channels should not change where gypsum board will be installed continuous within a room. Orient open leg of channel facing up to receive gypsum board.
 - 4. Locate channels a maximum of 3 inches from base of framing and top of framing.
 - 5. Hold back ends of channels 1/2 inch from intersecting surfaces. Add framing as required so that channels do not cantilever more than 6 inches.
 - 6. Align resilient channel so that attachment to framing member is through pre-drilled holes. Use only screws to attach resilient channels to framing members, **no** nails allowed.
 - 7. Do not install resilient channels on gypsum board surfaces, plywood shear walls, or like material.
 - 8. Resilient Channel Attachment: Use 1 inch Type S Bugle Head drywall, or similar, screws.
- B. 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.
- C. Walls indicated as Acoustic Assemblies:
 - 1. Install acoustic sealant in accordance with Section 07 92 00.
 - 2. Place one bead continuously on substrate before installation of perimeter framing members.
 - 3. Completely wrap all concealed sides of electrical boxes with RSIC Putty Pads, install in accordance with manufacturer's instructions.
 - a. If plastic boxes are used, replace any cracked or damaged boxes prior to installation of gypsum board.
 - 4. Seal perimeter of electrical boxes to gypsum board using acoustic sealant.
 - 5. Place continuous bead at perimeter of each layer of gypsum board.
 - 6. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.04 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

- B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
 - 1. Exception: Tapered edges to receive joint treatment at right angles to framing.
- C. Double-Layer Non-Rated: 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. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of non-rated double-layer assemblies, which may be installed by means of adhesive lamination.
- E. Walls indicated as Acoustic:
 - 1. Install gypsum board leaving 1/4 inch gap between at perimeter of wall surface, including bottom, top and sides intersecting with adjacent wall surfaces.
 - a. Install acoustic sealant in accordance with Section 07 92 00 at perimeter of acoustic wall assemblies in locations as described above.
 - b. Install gypsum board panels so that the long direction of the gypsum board panels are parallel to the resilient channels. Panels shall be centered on resilient channels.
 - 1) Orienting the long edge vertically is acceptable on walls where a single sheet of gypsum board extends from floor to ceiling.
 - 2. Attach gypsum board to resilient channels using screws, ensure that screws will not contact supporting framing members. Only attach gypsum board to resilient channels at locations **not** aligned with framing members
 - a. For single layer attachment of gypsum board to resilient channel use 1 inch long fastener.
 - b. When second layer is indicated to be attached to resilient channel use 1-1/2 inch long fastener.
 - 3. Electrical Box Putty Pads:
 - a. In full height, acoustic rated, and sound sensitive walls where electrical, telephone, and communication boxes share a stud cavity, cover the top, back and sides of with putty pad. Mold pads tightly to boxes and adjacent surfaces.
 - b. Ensure that unused knockouts in electrical, telephone, and communication boxes are plugged prior to installation of putty pad.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
 - 1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.06 GYPSUM BOARD SURFACE FINISH

- A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
 - a. Locations receiving wall coverings, glossy paints, or epoxy paint.
 - 2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 - a. All location unless otherwise noted.
 - 3. Level 3: Walls to receive textured wall finish.
 - 4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 - 5. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction.

- 6. Level 0: Temporary partitions.
 - 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 surfaces behind adhesive applied ceramic tile and fixed cabinetry.
 - 3. Taping, filling, and sanding are not required at base layer of double-layer applications.
- 3.07 TOLERANCES**
- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Acoustical units.
- B. Acoustical insulation above ceiling.
- C. Delegated design of seismic bracing of ceiling suspension system.

1.02 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Delegated Design Submittal:
 - 1. Refer to Section 01 35 73 for additional delegated design requirements.
 - 2. Suspended acoustical ceiling assemblies shall be engineered to withstand the affects of seismic movement on ceiling suspension system.
- C. Shop Drawings: Indicate grid layout and related dimensioning.
- D. Product Data: Provide data on suspension system components and acoustical units.
- E. Samples: Submit two full size samples illustrating material and finish of acoustical units.
- F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.03 QUALITY ASSURANCE

- A. Engineer Qualifications for Seismic Design: Perform under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the State in which the Project is located.
- B. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 3 years experience.
- C. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 3 years experience.

1.04 FIELD CONDITIONS

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

1.05 PROJECT CONDITIONS

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acoustic Panels (ACT):
 - 1. Armstrong World Industries, Inc: www.armstrong.com.
 - 2. CertainTeed Corporation: www.certainteed.com.
 - 3. USG: www.usg.com.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Suspension Systems:
 - 1. Same as for acoustical units.

2.02 PERFORMANCE CRITERIA

- A. Seismic Performance: Ceiling systems designed to withstand the effects of earthquake motions determined according to ASCE 7 for Seismic Design Category D, E, or F and complying with the following:
 - 1. Standard for Ceiling Suspension Systems Requiring Seismic Restraint:
 - a. Seismic Restraint is required for suspended ceiling systems 1,000 square feet or larger.
 - b. Install acoustic ceilings in accordance with ASTM E580, as modified by ASCE 13.5.6.2.2 (a through c) as amended by the Oregon State Structural Specialty Code, Section 1613.6.
 - 2. CISCAs Guidelines for Systems Requiring Seismic Restraint: Comply with CISCAs "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies.
 - 3. IBC Seismic Design Category for Project Site: As indicated on Drawings.
 - 4. Alternate methods approved by authority having jurisdiction (AHJ).
 - 5. Edge Molding Design: When required, provide face of molding less than 1 inch wide when using concealed seismic clip.
 - 6. Provide rigidly braced system.

2.03 ACOUSTICAL UNITS

- A. Acoustical Panels: Painted mineral fiber, with the following characteristics:
 - 1. Classification: ASTM E1264 Type III.
 - 2. Size: Refer to Schedule of Finishes on Drawings.
 - 3. Panel Edge: Square.
 - 4. Suspension System: Exposed grid.

2.04 SUSPENSION SYSTEM(S)

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
 - 1. Materials:
 - a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.
- B. Exposed Suspension System: Hot-dipped galvanized steel grid with aluminum cap.
 - 1. Application(s): Seismic.
 - 2. Structural Classification: Heavy-duty, when tested in accordance with ASTM C635/C635M.
 - 3. Profile: Tee; 15/16 inch face width.
 - 4. Color: Factory applied, White.
 - 5. Product: Refer to Schedule of Finishes on Drawings.

2.05 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:
 - 1. Same material and finish as grid.
 - 2. L-Shaped Molding: Less than 1 inch wide exposed face. Provide concealed seismic clip approved by AHJ.
 - 3. Finish: Primed for field painting.
- D. Seismic Joints: Provide manufacturer's seismic joint clip for ceiling areas exceeding 2500 square feet in area. Clips shall provide a minimum of 3/4 inch movement of main tees or cross tees.

- E. Acoustical Sealant For Perimeter Moldings: Specified in Section 07 92 00.
- F. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C 636/C 636M, ASTM C 636/C 636M, and ASTM C 636/C 636M and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Seismic Suspension System, Seismic Design Categories D, E, F: Hang suspension system with grid ends attached to the perimeter molding on two adjacent walls; on opposite walls, maintain a 3/4 inch clearance between grid ends and wall.
- D. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- E. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- F. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- G. Do not eccentrically load system or induce rotation of runners.
- H. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Overlap and rivet corners at 2 adjacent walls.

3.03 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

3.04 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.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient base.
- B. Installation accessories.

1.02 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. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Wall Base: 2 percent of each type and color.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum 3 years experience.
- B. Installer Qualifications: Company specializing in installing specified flooring with minimum 3 years experience.

1.04 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. Protect roll materials from damage by storing on end.

1.05 FIELD CONDITIONS

- A. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- B. 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

2.01 RESILIENT BASE

- A. Resilient Base (RB-1): ASTM F1861, Type TS rubber, vulcanized thermoset; Style B, Cove.
 - 1. Manufacturers:
 - a. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
 - b. Mannington Commercial: www.manningtoncommercial.com/#sle.
 - c. Roppe Corporation; Contours Profiled Wall Base System: www.roppe.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or ASTM E 648.
 - 3. Height: 4 inch.
 - 4. Thickness: 0.125 inch.
 - 5. Finish: Satin.
 - 6. Length: 4 foot sections.
 - 7. Length: Roll.

8. Accessories: Premolded external corners and internal corners.
- 2.02 ACCESSORIES**

A. Adhesives: Waterproof; types recommended by wall base manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- B. Adhesive bond and compatibility testing:
1. Comply with requirements and recommendations of manufacturer.
 2. Testing to be done in accordance with manufacturer's recommended test method.

3.02 PREPARATION

- A. Clean substrate.

3.03 INSTALLATION - GENERAL

- A. Install in accordance with manufacturer's instructions. Apply materials with manufacturer approved adhesives for appropriate and correctly prepared substrates.

3.04 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
- B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

3.05 CLEANING

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

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fluid-applied flooring and base.

1.02 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; and colors available.
- C. Samples: Submit two samples, 6 by 6 inch in size illustrating color and pattern for each floor material for each color specified.
- D. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and application rate for each coat.
- F. Manufacturer's Qualification Statement.
- G. Applicator's Qualification Statement.
- H. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section.
 - 1. Minimum 3 years of experience.
 - 2. Approved by manufacturer.

1.04 MOCK-UPS

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Construct mock-up(s) of fluid applied flooring to serve as basis for evaluation of texture and workmanship.
 - 1. Number of Mock-Ups to be Prepared: One.
 - 2. Use same materials and methods for use in the work.
 - 3. Locate where directed.
 - 4. Minimum Size: 48 inches by 48 inches.
- C. Obtain approval of mock-up by Architect before proceeding with work.
- D. Approved mock-up may remain as part of the work.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store resin materials in a dry, secure area.
- B. Store materials for three days prior to installation in area of installation to achieve temperature stability.
- C. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.

2. Remove rags and waste from storage areas daily.

1.06 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

2.01 MANUFACTURERS

- A. Fluid-Applied Flooring - Basis of Design:
 1. Sherwin-Williams Company; Resufloor Topfloor SL23: www.industrial.sherwin-williams.com.
 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FLUID-APPLIED FLOORING SYSTEMS

- A. Fluid-Applied Flooring (FAF-1): Epoxy, slurry-coat. Abrasion, impact and chemical-resistant, high-performance, resin-based, monolithic floor surfacing designed to produce a seamless floor.
 1. Total System Thickness: 1/16 inch, normal, when dry.
 2. Texture: Smooth.
 3. Wall Base: 6 inch high coved wall base with 3/4 or 1 inch cove. Epoxy fill feather edge against interior partition drywall.
 4. Color: As selected by Architect.

2.03 ACCESSORIES

- A. Joint Treatment: Fiberglass Scrim tape, as recommended by manufacturer.
- B. Subfloor Filler: Type recommended by fluid-applied flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive flooring.
- C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.
- D. Verify that concrete sub-floor surfaces are within acceptable moisture levels in accordance with flooring manufacturer's requirements and ready for flooring installation by testing for relative humidity and alkalinity of concrete in accordance with Section 09 05 61.
- E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.
- B. Vacuum clean substrate.
- C. Surface Preparation: Remove all surface contamination, loose or weakly adherent particles, laitance, grease, oil, curing compounds, paint, dust and debris by blast track method or

approved mechanical means (acid etch not allowed). If surface is questionable, try a test patch. Create a minimum surface profile for the system specified in accordance with the methods described in ICRI No. 03732 to achieve profile CSP 4-6.

- D. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
- E. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.
- F. Apply primer to surfaces required by flooring manufacturer.

3.03 INSTALLATION - FLOORING

- A. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.
- B. Apply in accordance with manufacturer's instructions.
- C. Apply each coat to minimum thickness required by manufacturer.
- D. Install resinous floor over properly prepared concrete surface in strict accordance with the manufacturer's directions.
 - 1. Install the primer and/or base coats over thoroughly cleaned and prepared concrete.
 - 2. Maintain a slab temperature of 60°F to 80°F for 24 hours minimum before applying floor topping, or as instructed by manufacturer.
- E. Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
 - 1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
 - 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
 - 3. At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.
- F. Sealant: Saw cut resinous floor topping at expansion joints in concrete slab. Fill sawcuts with sealant prior to final seal coat application. Follow manufacturer's written recommendations.
- G. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- H. Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer.
- I. Finish to smooth, level surface.
- J. Cove at vertical surfaces.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Test installed floor surface in accordance with ANSI/ESD STM7.1 .

3.05 PROTECTION

- A. Prohibit traffic on floor finish for 48 hours after installation.
- B. Barricade area to protect flooring until fully cured.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Carpet tile, fully adhered.

1.02 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate layout of joints.
- C. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.
- E. Manufacturer's Installation Instructions: Indicate special procedures.
- 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.

1.03 QUALITY ASSURANCE

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

1.04 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Tile Carpeting: Refer to Schedule of Finishes on Drawings.
 - 1. J+J Flooring: www.jjflooringgroup.com.

2.02 MATERIALS

- A. Tile Carpeting: Tufted, manufactured in one color dye lot.
 - 1. Tile Size: 18 by 18 inch, nominal.
 - 2. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
 - 3. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
 - 4. VOC Content: Provide CRI Green Label Plus certified product; in lieu of labeling, independent test report showing compliance is acceptable.

2.03 ACCESSORIES

- A. Sub-Floor Filler: Modified Portland cement type recommended by flooring material manufacturer.
- B. Edge Strips: Rubber, color as selected by Architect.
- C. Adhesives: Acceptable to carpet tile manufacturer, compatible with materials being adhered; maximum VOC of 50 g/L; CRI Green Label certified; in lieu of labeled product, independent

test report showing compliance is acceptable.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.
- C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.
- D. Verify that concrete sub-floor and cast underlayment surfaces are within acceptable moisture levels in accordance with flooring manufacturer's requirements and ready for flooring installation by testing for relative humidity and alkalinity of concrete and cast underlayment in accordance with Section 09 05 61.
- E. Adhesive bond and compatibility testing:
 - 1. Comply with requirements and recommendations of manufacturer.
 - 2. Testing to be done in accordance with manufacturer's recommended test method.
- F. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.
- B. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.
- C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- D. Vacuum clean substrate.

3.03 INSTALLATION

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions and CRI 104 (Commercial).
- C. Blend carpet from different cartons to ensure minimal variation in color match.
- D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- E. Lay carpet tile in pattern to match existing, with pile direction in the same direction as the nearby existing carpet tile.
- 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.

3.04 CLEANING

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

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints, stains, varnishes, and other coatings.
- C. Surfaces to be finished are indicated in this section and on the Drawings.
- D. Surfaces to receive high performance coating are indicated in Section 09 96 00.

1.02 DEFINITIONS

- A. Sheen Levels: As defined by MPI except this specification uses common names defined below rather than numbered levels:
 - 1. Flat or Matte: Gloss Level 1
 - 2. Velvet: Gloss Level 2
 - 3. Eggshell: Gloss Level 3
 - 4. Satin: Gloss Level 4
 - 5. Semi-gloss: Gloss Level 5
 - 6. Gloss: Gloss Level 6
 - 7. High Gloss: Gloss Level 7
- B. VOC Ranges: As defined by MPI, the following VOC ranges as indicated in Part 3 - Paint Schedules. Noted in "grams per Liter" (g/L)

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of all 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. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
 - 3. Manufacturer's installation instructions.
- C. Schedule of Paints: List each coating and finish system for all surfaces that require paint. List special washes, surface preparation, sealers, primers, intermediate coats and final coats.
 - 1. Identify each material by the manufacturer's catalog number and general classification.
 - 2. List dry film thickness for each coat in each finish system
 - 3. Identify minimum total dry film thickness for each system.
- D. Certification by listed Manufacturer's Representative that products comply with Contract Documents and are compatible with applicable substrates and with each other.
- E. Samples: Submit three paper "drop" 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, submit each color in each sheen available.
 - 3. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, have been approved.
- F. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.04 QUALITY ASSURANCE

- A. Minimum Standard: MPI "Architectural Painting Specification Manual" and "MPI Approved Products List" and GreenSeal Label (GS-11).
 - 1. MPI Renovation Standard: "Maintenance and Repair Manual."
- B. Acceptable Manufacturers and Manufacturer's Representative: Direct employee of Manufacturer who is authorized by Manufacturer to perform duties specified in this Section:
 - 1. Benjamin Moore & Company: Amy Griffin
 - 2. Miller Paint Company: Melanie Gibbs.
 - 3. PPG Industries, Inc.; Architectural Coatings; Susan Williams, CSI
 - 4. Rodda/Cloverdale: Jeff McIntyre.
 - 5. Sherwin-Williams: Anna Atchison, CSI, CDT

1.05 MOCK-UP

- A. See Section 01 43 39 - Coordinated Mock-ups, for general requirements for mock-up.
- B. Provide wall panel, 10 feet long by 10 feet wide, illustrating coating color, texture, and finish.
- C. Provide door and frame assembly illustrating coating color, texture, and finish.
- D. Locate where directed.
- E. Mock-up may remain as part of the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

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

1.07 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- E. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.
- F. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.08 EXTRA MATERIALS

- A. See Section 01 60 00 - Product Requirements, for additional provisions.
- B. Supply 1 gallon of each color; store where directed.
- C. Label each container with color in addition to the manufacturer's label.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers are listed in Part 1, Quality Assurance.
 - 1. Submit Substitution Requests for paint systems by acceptable Manufacturers per Section 01 60 00.
- B. Provide paint and coating products used in any individual system from the same manufacturer; no exceptions.
 - 1. Coordinate shop applied metal primers and intermediate coats with work in Division 05.
- C. Provide paint and coating products from the same manufacturer to the greatest extent possible.
- D. In the event that a single manufacturer cannot provide all specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
 - 1. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.
- E. Subject to compliance with the specifications, Basis of Design products are from the following:
 - 1. Benjamin Moore & Co. (B-M).
 - 2. Sherwin Williams (S-W)

2.02 MATERIALS - GENERAL

- A. Volatile Organic Compound (VOC) Content and minimum quality:
 - 1. Provide coatings that comply with the most stringent requirements specified in the following:
 - a. Refer to Section 01 60 00.
 - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), inclusive of colorants added to a tint base and exclusive of water added at project site; or other method acceptable to authorities having jurisdiction.
- B. Paints and Coatings: Provide products listed in Painting Schedules below:
 - 1. Provide ready mixed paints and coatings, except field-catalyzed coatings.
 - 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 - 3. Provide products in manufacturer's containers with GreenSeal Label where indicated.
- C. Accessory Materials: Sealers, paint thinners and other materials not specifically indicated but required to achieve the finishes specified; commercial quality.
- D. Patching Material: Latex filler.
- E. Fastener Head Cover Material: Latex filler.

2.03 PAINT SYSTEMS

- A. Provide Premium Grade systems (2 top coats) as defined in MPI Architectural Painting Specification Manual.
- B. Where sheen is not specified or more than one sheen is specified, sheen will be selected during Submittals by Architect from the manufacturer's full line.
- C. Provide colors as directed by Architect.

PART 3 EXECUTION

3.01 SCOPE -- SURFACES TO BE FINISHED

- A. Paint all exposed surfaces except where indicated not to be painted or to remain natural; the term "exposed" includes areas visible through permanent and built-in fixtures when they are in place.
- B. Paint the surfaces described in Painting Schedule at end of PART 3, indicated on the Drawings, and as follows:
 - 1. If a surface, material, or item is not specifically mentioned, paint in the same manner as similar surfaces, materials, or items, regardless of whether colors are indicated or not.
 - 2. Paint surfaces behind movable equipment and furnishings the same as similar exposed surfaces.
 - 3. Paint surfaces to be concealed behind permanently installed fixtures, equipment, and furnishings, using primer only, prior to installation of the permanent item.
 - 4. Paint back sides of access panels and removable and hinged covers to match exposed surfaces.
 - 5. Paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment occurring in finished areas to match background surfaces, unless otherwise indicated.
 - 6. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
 - 7. Paint interior surfaces of air ducts and convector and baseboard heating cabinets with flat, nonspecular black paint where visible through registers, grilles, or louvers.
 - 8. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
- C. Do Not Paint or Finish the Following Items:
 - 1. Items fully factory-finished unless specifically noted; factory-primed items are not considered factory-finished.
 - 2. Items indicated to receive other finish.
 - 3. Items indicated to remain naturally finished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Anodized aluminum.
 - 6. Polished and brushed stainless steel items.
 - 7. Brick, precast concrete, integrally colored plaster.
 - 8. Acoustical materials.
 - 9. Concealed piping, ductwork, and conduit.

3.02 EXAMINATION

- A. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials; report incompatible primer conditions and submit recommended changes for Architect's approval.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Plaster and Gypsum Board: 12 percent.
 - 2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
 - 3. Exterior Wood: 15 percent.

- E. Measure the ph level of concrete, masonry, and mortar before starting any finishing process, using the method recommended by MPI Architectural Painting Manual.
 - 1. Report results in writing to Architect before starting work.
 - 2. If results of test indicates need for remedial action, provide written description of remedial action. If a different primer or paint systems is required, state the total cost of the change. Do not proceed with remedial action or change without receiving written authorization from Architect.

3.03 PREPARATION

- A. Prepare surfaces as specified in MPI Architectural Painting Specification Manual and as follows for the applicable surface and coating; if multiple preparation treatments are specified, use as many as necessary for best results; where the Manual references external standards for preparation (e.g. SSPC standards), prepare as specified in those standards; comply with coating manufacturer's specific preparation methods or treatments, if any.
- B. Coordinate painting work with cleaning and preparation work so that dust and other contaminants do not fall on newly painted, wet surfaces
- C. Surface Appurtenances: Prior to preparing surfaces or finishing, remove electrical plates, hardware, light fixtures, light fixture trim, escutcheons, machined surfaces, fittings, and similar items already installed that are not to be painted.
 - 1. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before preparation and finishing.
 - 2. After completing painting in each space or area, reinstall items removed using workers skilled in the trades involved.
- D. Surfaces: Correct defects and clean surfaces which affect work of this section.
- E. Marks: Seal with shellac-based primer those which may bleed through surface finishes.
- F. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- G. Concrete, Cement Plaster and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
 - 1. Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 - 2. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
 - 3. Determine alkalinity and moisture content of surfaces by performing appropriate tests as specified in MPI Manual. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture is present.
 - 4. Etch concrete as specified in MPI Architectural Painting Specification Manual .
- H. Gypsum Board Surfaces to be Painted:
 - 1. Where vapor barrier primer is indicated to be applied, product must be applied after gypsum board is fastened to studs and prior to the application of any Joint Materials. Apply second coat after application of Joint Materials, to the finish level indicated, and joint materials have adequately cured.
 - 2. Fill minor defects with filler compound. Spot prime defects after repair.

- I. Plaster Surfaces to be Painted: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- J. Insulated Coverings to be Painted: Remove dirt, grease, and oil from canvas and cotton.
- K. Aluminum Surfaces to be Painted: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.
- L. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
 - 1. Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical or chemical methods as recommended as best practice by primer manufacturer.
- M. Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.
 - 1. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.
- N. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
- O. Interior Wood Items to Receive Transparent Finish: Sand wood to obtain a uniform appearance before immediately starting work. Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.
- P. Exterior Wood to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.
- Q. Site-finished exterior wood scheduled to receive stained finish:
 - 1. Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer.
 - 2. Remove discoloration and surface defects, including water stains, scuff marks and other marks, prior to application of finish material.
 - 3. Fill nail holes with tinted exterior sealant compound after stain has been applied.
 - 4. Sand siding surfaces prior to application of stain using 60 to 80 grit sand paper, sanding with the grain of the wood
- R. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

3.04 APPLICATION

- A. Apply products in accordance with manufacturer's instructions and as specified or recommended by MPI Manual, using the preparation, products, sheens, textures, and colors as indicated.

1. Remove, refinish, or repaint work not complying with requirements.
- B. Do not apply finishes over dirt, rust, scale, grease, moisture, scuffed surfaces, or other conditions detrimental to formation of a durable coating film; do not apply finishes to surfaces that are not dry.
- C. Use applicators and methods best suited for substrate and type of material being applied and according to manufacturer's instructions.
 1. Brush Application: Use brushes best suited for the type of material applied; use brush of appropriate size for the surface or item being painted; produce results free of visible brush marks.
 2. Roller Application: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
 3. Spray Application: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
 4. Where application method is listed in the MPI Manual for the paint system that application method is required; otherwise any application method recommended by manufacturer for material used and objects to be painted is acceptable.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate; provide total dry film thickness of entire system as recommended by manufacturer.
 1. Number of coats and film thickness required are the same regardless of application method.
 2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance.
 3. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent to that of flat surfaces.
- E. Apply finish to completely cover surfaces with uniform appearance without brush marks, runs, sags, laps, ropiness, holidays, spotting, cloudiness, or other surface imperfections.
 1. Before applying finish coats, apply a prime coat of material recommended by manufacturer, unless the surface has been prime coated by others; where evidence of suction spots or unsealed areas in first coat appear, recoat primed and sealed surfaces to ensure finish coat with no burn through or other defects due to insufficient sealing.
 2. Apply first coat to surface that has been cleaned, pretreated, or otherwise prepared as soon as practical after preparation and before subsequent surface deterioration.
 3. Do not apply succeeding coats until the previous coat has cured as recommended by manufacturer.
 4. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat will not cause the undercoat to lift or lose adhesion.
 5. If manufacturer's instructions recommend sanding to produce a smooth, even surface, sand between coats.
 6. Before applying next coat vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
 7. Pigmented (Opaque) Finishes on Doors, Frames, Trim: Provide smooth, opaque surface of uniform finish, color, appearance, and coverage.
 8. Transparent Finishes: Smooth, glass-like.
 9. Exterior wood to receive stained finish: Apply stain to front, back and sides of wood scheduled to receive stained finish. Where wood is cut
 10. Stippled Finish on Walls, Ceilings, Soffits: Roll and redistribute paint to even, fine texture; leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections; back roll final coat to achieve a uniform surface.

3.05 WALL IDENTIFICATION

- A. Coordinate wall identification with Section 07 84 00.
- B. Identify walls indicated as fire and/or smoke barriers, smoke partitions using painted stencils with the following information:
 - 1. "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS" with letters a minimum of 3 inch in height.
- C. Apply to wall surfaces in accessible concealed floor, floor-ceiling or attic spaces. Locate within 15 feet of each end of each wall and at intervals not exceeding 30 feet horizontally along wall or partition so signs will be visible to anyone seeking to remove penetrating items or firestopping.

3.06 CLEANING AND PROTECTION

- A. Collect waste material which may constitute a fire hazard, place in closed metal containers, and remove daily from site.
- B. At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from site.
- C. Protect other work, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting as approved by Architect.
- D. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
- E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in MPI Manual.

3.07 PAINTING SCHEDULE - INTERIOR SURFACES

- A. Paint colors: Refer to Schedule of Finishes on Drawings.
- B. Concrete:
 - 1. Applications include, but are not limited to, walls, soffits, and underside of concrete slabs.
 - 2. Primer: One coat.
 - a. MPI Criteria:
 - 1) MPI Category: #149
 - 2) MPI VOC Range: E3
 - b. B-M: Ultra Spec 500 Ultra Spec 500 Interior Primer 534 and insert product name and number
 - c. S-W: ProMar 200 Zero VOI Interior Latex Primer, B28W2600.
 - 3. Finish: Two coats.
 - a. MPI Criteria:
 - 1) MPI Category: #143
 - 2) MPI VOC Range: E3
 - b. B-M: Ultra Spec 500 Low Sheen 537
 - c. S-W: ProMar 200 Zero VOC Flat
- C. Metal - Ferrous:
 - 1. Applications include, but are not limited to, Structural Steel and Metal Fabrications.
 - 2. Primer: One coat.
 - a. MPI Criteria:
 - 1) MPI Category: #107
 - 2) MPI VOC Range: E2
 - b. B-M: Super Spec HPTM P04 Acrylic Metal Primer
 - c. S-W: ProIndustrial Pro-Cryl Universal Primer, B66W1310.
 - 3. Finish: Two coats.

- a. MPI Criteria:
 - 1) MPI Category: #147
 - 2) MPI VOC Range: E1
 - b. B-M: Ultra Spec HP DTM Semi-Gloss HP29
 - c. S-W: ProIndustrial Acrylic Semi-Gloss, B66-650 Series.
- D. Metal - Galvanized:
- 1. Applications include, but are not limited to, Structural Steel and Metal Fabrications.
 - 2. Primer: One coat.
 - a. MPI Criteria:
 - 1) MPI Category: #107
 - 2) MPI VOC Range: E3
 - b. B-M: Super Spec HPTM P04 Acrylic Metal Primer
 - c. S-W: ProIndustrial Pro-Cryl Universal Primer, B66W1310
 - 3. Finish: Two coats.
 - a. MPI Criteria:
 - 1) MPI Category: #153 or #161
 - 2) MPI VOC Range: E3, post tint
 - b. B-M: Ultra Spec HP DTM Acrylic Low Luster HP25
 - c. S-W: ProIndustrial DTM Acrylic EG-Shel, B66-1250 Series
- E. Wood - Dressed Lumber:
- 1. Applications include, but are not limited to, paneling, wainscoting, casework, and standing and running trim.
 - 2. Primer: One coat.
 - a. MPI Criteria:
 - 1) MPI Category: #137
 - 2) MPI VOC Range: E3
 - b. B-M: Sure Seal 027
 - c. S-W: Multi-purpose Latex Primer, B51W450.
 - 3. Finish: Two coats.
 - a. MPI Criteria:
 - 1) MPI Category: #146
 - 2) MPI VOC Range: E3
 - b. B-M: Ultra Spec 500 Semi-Gloss 539
 - c. S-W: ProIndustrial Acrylic Gloss, B66-600
 - 4. Stain: One coat(s).
 - a. MPI Criteria:
 - 1) MPI Category: #16
 - 2) MPI VOC Range: E3
 - b. B-M: Arborcoat Waterborne Solid Color Deck & Siding Stain, 640
 - c. S-W: Woodscapes Solid Color Acrylic Stain, A15-50
 - 5. Transparent Finish: One coat(s).
 - a. MPI Criteria:
 - 1) MPI Category: #156
 - 2) MPI VOC Range: E2
 - b. B-M: Arborcoat Waterborne Transluscent Stain 623
 - c. S-W: Superdeck Log Home Stain, SD8T200.
- F. Metal - Primed:
- 1. Applications include, but are not limited to, Doors, Frames, and Borrowed lites.
 - 2. Primer - Primer not required on factory-primed surface, check compatibility of factory-applied primer with finish coat indicated: One coat.
 - a. MPI Criteria:

- 1) MPI Category: #107
- 2) MPI VOC Range: E2
- b. B-M: Super Spec HPTM P04 Acrylic Metal Primer
- c. S-W: ProIndustrial Pro-Cryl Universal Primer, B66W1310.
3. Finish: Two coats.
 - a. MPI Criteria:
 - 1) MPI Category: #153
 - 2) MPI VOC Range: E2
 - b. B-M: Ultra Spec HP DTM Semi-Gloss HP29
 - c. S-W: ProIndustrial DTM Acrylic Semi-gloss, B66-1150
- G. Gypsum Board:
 1. Applications include, but are not limited to, walls, soffits, ceilings, and insert other gypsum board surfaces.
 2. Primer form priming glass mat gypsum board substrates scheduled to receive Finish Coats: One coat primer.
 - a. MPI Criteria:
 - 1) MPI Category: #137
 - 2) MPI VOC Range: E3
 - b. B-M: Sure Seal Latex Primer/Sealer 027
 - c. S-W: Multi-purpose Latex Primer, B51W450.
 3. Primer: One coat.
 - a. MPI Criteria:
 - 1) MPI Category: #149
 - 2) MPI VOC Range: E3
 - b. B-M: Ultra Spec 500 Interior Primer 534
 - c. S-W: ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
 4. Finish: Two coats.
 - a. MPI Criteria:
 - 1) MPI Category: #144 and #146
 - 2) MPI VOC Range: E3
 - b. MPI VOC Range: E3
 - c. B-M: Ultra Spec 500 Low Sheen 537 and Semi-Gloss 539
 - d. S-W: ProMar 200 HP Zero VOC Low Gloss Eg-shel B41-1900 Series
- H. Gypsum Board - Holding Room Epoxy (EP-1):
 1. Product: Sherwin-Williams; Resuwall, Aqua FR.
 2. Applications includewalls and ceilings.
 3. Primer: One coat.
 - a. S-W: Sherwin-Williams Resuwall, Aqua, FR, 3462A and 3462B Epoxy Primer
 4. Body/Intermediate: One coat.
 - a. S-W: Sherwin-Williams, Resuwall, Aqua, FR, 3462G and 3462B Epoxy Body/Intermediate Coat
 5. Topcoat: One coat.
 - a. S-W: Sherwin-Williams, Resuwall, Aqua, FR, 3462A and 3462B Epoxy Topcoat

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Laminated fiberglass ballistic-resistant panels.

1.02 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.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's current data sheets on each product to be used.
- C. Shop Drawings: Details of installation of ballistic-resistant panels, including plan views, elevations, sections, and details of the proposed installation with attachment methods.
- D. Samples: Submit two samples, minimum size 6 inches by 6 inches, for each product specified.
- E. Certificates: Submit printed data to indicate compliance with following requirements.
 - 1. UL Listing verification and UL 752 Current Test Results as provided by Underwriters Laboratories.
- F. Manufacturer's Instructions: Indicate preparation and installation.
- G. Manufacturer's qualification statement.
- H. Installer's qualification statement.
- I. Specimen Warranty: Manufacturer warranty.

1.04 QUALITY ASSURANCE

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

1.05 MOCK-UPS

- A. Construct mock-up, 10 ft long by 10 ft high minimum dimensions, illustrating surface preparation techniques and application workmanship.
- B. Locate where directed.
- C. Mock-ups may remain as part of the work.

1.06 DELIVERY, STORAGE, AND HANDLING

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

1.07 FIELD CONDITIONS

- A. Install products under environmental conditions (temperature, humidity, and ventilation) recommended by manufacturer.

1.08 WARRANTY

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

- B. Manufacturer Warranty: Provide ten year manufacturer warranty for materials and workmanship against defects commencing on the Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Laminated Glass Fiber Ballistics-Resistant Panels:
1. Basis of Design: Armortex; Bullet-Resistant Fiberglass Panels: www.armortex.com.
 2. Other acceptable manufacturers:
 - a. Insulgard Security Products: www.insulgard.com.
 - b. Total Security Solutions: www.tssbulletproof.com.
 - c. U.S. Bullet Proofing: www.usbulletproofing.com.

2.02 PERFORMANCE REQUIREMENTS

- A. Ballistic Resistance Rating: Listed and labeled as tested in accordance with UL 752 Level 3 threat rating (high-power handgun, .44 magnum lead semi-wadcutter gas checked, 240 grain, 1350 fps, 3 shots).
- B. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when tested in accordance with ASTM E84.

2.03 LAMINATED FIBER BALLISTICS-RESISTANT PANELS

- A. General: Laminated fiber ballistic-resistant panels to be non-ricochet type. When struck by a bullet or projectile, the panels to delaminate in such a way that absorbs the energy, stops the projectile, and prevents ricochet or spalling of the panel.
- B. Laminated Fiber Panels:
1. Material: Multiple layers of fiberglass woven roving bonded together with resin and compressed into flat rigid sheets.
 2. Panel Size: Maximum size to limit number of seams.
 3. Panel Thickness: 1/2 inches.
 4. Panel Weight: 5.2 psf minimum.
 5. Attachment Method: Mechanical fasteners.

2.04 ACCESSORIES

- A. Seam Batten: Manufacturer's standard back-up layer of ballistic-resistant material; minimum 4 inches width.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Verify that substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation of this work.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving performance requirements indicated.

3.03 INSTALLATION

- A. Install panels in accordance with manufacturer's instructions and shop drawings and in proper relationship with adjacent construction.

1. Maintain ballistic-resistive rating at panel junctures with floor deck and deck above, bullet-resistive door and window frames, and required penetrations.
- B. Reinforce panel joints with a minimum 4 inch wide seam batten, centered on panel joints, to prevent projectile passage and spalling of panel.
- C. Secure panels to framing using manufacturer-recommended screws or industrial adhesive.

3.04 PROTECTION

- A. Protect installed panels from subsequent construction operations.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Institutional ligature-resistant toilet accessories.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of internal wall reinforcement to receive anchor attachments.

1.03 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

2.01 MANUFACTURERS

- A. Institutional Security and Ligature-Resistant Toilet and Bath Accessories:
 - 1. Basis of Design: Whitehall Manufacturing; Best Care: www.whitehallmfg.com.
 - 2. Other Acceptable Manufacturers:
 - a. Bobrick Washroom Equipment, Inc.: www.bobrick.com
 - 3. Substitutions: Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE CRITERIA

- A. Structural Performance of Grab Bars: Provide grab bars capable of withstanding the effects of loads per ASTM F446.
 - 1. Grab bars shall resist a Push/Pull Point Load of 250 pound-force, minimum.
- B. Accessibility: Comply with ICC A117.1 and ADA Standards.

2.03 MATERIALS

- A. Accessories - General: Shop-assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
 - 1. Grind welded joints smooth.
 - 2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.
- B. Keys: Master key lockable accessories; Provide 5 keys for each accessory to Owner.
- C. Stainless Steel Sheet: ASTM A666, Type 304.
- D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- E. Adhesive: Two component epoxy type, waterproof.
- F. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.04 FINISHES

- A. Stainless Steel: No. 4 directional polish; satin finish, unless otherwise noted.
- B. Powder-Coated Steel: Clean, degrease, and neutralize. Follow immediately with a phosphatizing treatment, prime coat, and two finish coats of powder coat enamel.

**2.05 INSTITUTIONAL SECURITY AND LIGATURE-RESISTANT TOILET AND BATH
ACCESSORIES**

- A. Toilet Paper Holder: Single roll, recessed unit with beveled wall flange, white powder coated stainless steel, spring-loaded spindle button type for standard toilet paper rolls. Install with tamper-resistant screws.
 - 1. Product: Model WH1847B.
- B. Paper Towel Holder: Folded paper type, single bay, satin finish stainless steel, surface-mounted, with open bays as refill indicators. Install with tamper-resistant screws.
 - 1. Capacity: 250 C-fold minimum per bay.
 - 2. Product: Model WH1181.
- C. Mirrors: Stainless steel framed, Type 400 polished stainless steel mirror; Concealed front mount.
 - 1. Framed Size: 13 inches by 16 inches.
 - 2. Frame: Satin finish stainless steel with mitered beveled edges and welded and ground corners, and tamperproof hanging system; Square corners.
 - 3. Product: Model 1850-SLPT-SS.
- D. Grab Bars: Type 304 stainless steel, smooth surface with closure plate.
 - 1. Standard Duty Grab Bars:
 - a. Push/Pull Point Load: 250 pound-force, minimum.
 - b. Dimensions: 1-1/2 inch outside diameter, minimum 0.05 inch wall thickness, 1-1/2 inch clearance between wall and inside of grab bar; 14 gauge stainless steel "L" shaped closure plate with wall mounting flange welded to bottom of tube to prevent ligature. Install grab bar and closure plate with tamper-resistant screws through grab bar circular mounting flange and wall flange of flat closure.
 - c. Length and Configuration: As indicated on drawings.
 - d. Product: WH1109-2

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions prior to starting work.
- B. Verify exact location of accessories for installation.
- C. Verify that field measurements are as indicated on drawings.

3.02 PREPARATION

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

3.03 INSTALLATION

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

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Custom fabricated standard and accessible lockers.
 - 1. Type: High Pressure Decorative Laminate.
- B. Locker hardware.

1.02 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Provide a layout plan and provide details indicating materials, component profiles, fastening methods, jointing details, and accessories.
- C. Product Data: Provide data for each type of product and process specified in this section and incorporated into fabrication of lockers. Include requirements for site preparation and installation of lockers.

1.03 QUALITY ASSURANCE

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; Architectural Woodwork Institute, Architectural Woodwork Manufacturers Association of Canada, and Woodwork Institute; 2014 2nd Edition.
- B. Manufacturer Qualifications:
 - 1. Company specializing in fabricating the products specified in this section with minimum 5 years of experience.
 - 2. Manufacturer shall be certified for chain of custody by an FSC-accredited certification body.
 - 3. Complete knowledge of AWS standards.
- C. Installer Qualifications: Employee of manufacturer or subcontracted to manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage.
- B. Protect components during transit, delivery, storage, and handling to prevent damage, soiling, and deterioration.
- C. Do not deliver until painting, wet work, grinding, and similar operations that could damage, soil, or deteriorate components have been completed in installation areas. If components must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in "Project Conditions."

1.05 FIELD CONDITIONS

- A. Environmental Conditions: Obtain and comply with Woodwork Manufacturer's and Installer's coordinated advice for optimum temperature and humidity conditions for woodwork during its storage and installation. Do not install woodwork until these conditions have been attained and stabilized so that woodwork is within plus or minus 1.0 percent of optimum moisture content from date of installation through remainder of construction period.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design Manufacturer: Legacy Lockers, Inc.: www.legacylockers.com
- B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 LOCKERS

- A. AWS Quality Grade: Unless otherwise indicated provide products of quality specified by AWI/AWMAC/WI (AWS) for Custom Grade.
- B. Lockers:
 - 1. Finish - Exposed Exterior Surfaces: Decorative laminate.
 - 2. Finish: Semi-exposed Surfaces: Thermoset Decorative Overlay (TDO).
 - 3. Finish - Concealed Surfaces: Thermoset Decorative Overlay (TDO).
- C. Lockers: Four tier plastic laminate lockers, wall mounted with matching closed base.
 - 1. Width: 12 inches.
 - 2. Depth: 15 inches.
 - 3. Height: 72 inches (including all tiers).
 - 4. Locking: Token lock system. Verify function and token quantity with Owner.

2.03 MATERIALS

- A. General: Provide materials that comply with reference standard and specified requirements.
- B. Formaldehyde Free: Provide composite wood products with no added formaldehyde, made without urea-formaldehyde adhesives or binders.
- C. Minimum Thickness (unless otherwise noted or as required by AWS): Nominal 5/8 inch.
- D. Particleboard: ANSI A208.1, Grade M-2 made with binder containing no urea formaldehyde.
- E. Thermoset Decorative Overlay (TDO): Particleboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
 - 1. Color: to be selected from manufacturer's standard finishes by Architect. .

2.04 DECORATIVE LAMINATE MATERIALS

- A. Manufacturers:
 - 1. Formica Corporation: www.formica.com.
 - 2. Wilsonart: www.wilsonart.com.
 - a. Color and Finish: As selected from manufacturers standard colors.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.

2.05 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Edge Banding: Use the following where indicated.
 - 1. Polyvinyl-chloride (PVC) edge banding.
 - 2. Thickness: 1.5 mm, minimum
- C. Fasteners: Size and type to suit application.
- D. Concealed Joint Fasteners: Threaded steel and wood doweled.

2.06 HARDWARE

- A. Finish: Brushed nickel for hardware on outside face of lockers.
- B. Accessible locker hardware shall be mounted in accordance with accessibility standards per ADA Standards.
- C. Pulls: Wire pull to match lock finish.
- D. Hinges: European style concealed self-closing type, steel with polished finish.
 - 1. Degree of opening: 110 degree typical,
 - 2. Hinge quantity:

- a. 2 hinges per door for lockers 35 inches high and smaller.
- E. Bumper: Clear rubber.
- F. Shelf: Accessible lockers shall have 1 shelf.
- G. Lock: Token lock system. Verify function and token quantity with Owner.
- H. Number disk: 1-1/2 inch diameter flush mounted, with 3/8 inch high contrasting digits. Font style: US Block 1L.

2.07 FABRICATION

- A. Wood Moisture Content: Comply with requirements of referenced quality standard for moisture content of lumber in relation to relative humidity conditions existing during time of fabrication and in installation areas.
- B. Assembly: Shop assemble lockers for delivery to site in units easily handled and to permit passage through building openings.
 - 1. Complete fabrication, including assembly, finishing, and hardware application, before shipment to project site to maximum extent possible.
 - 2. Fabricate lockers square, rigid and without warp, with the finished faces flat and free of scratches and chips.
 - 3. Machine parts and attachment holes accurately and without chips.
 - 4. Provide 1 coat rod and 1 coat hook per locker.
- C. Edge Banding: Edge band shelves, doors, and exposed exterior edges with specified edge banding. Do not use more than one piece for any single length.
 - 1. Edge Band: Pressure bonded to core with waterproof, hot melt adhesive at exposed and semi-exposed edges.
- D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets. Fit corners and joints hairline.
- E. Shelves: ADA lockers only.
 - 1. Core Material: 5/8 inch thick TDO core.
 - 2. Provide 1 shelf at each accessible locker.
- F. Locker Venting: Provide 12 mm gap between door and top and bottom of each locker to provide continuous natural air flow.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify bases are complete and correctly located..

3.02 PREPARATION

- A. Before installing lockers, examine shop-fabricated work for completion and complete work as required.

3.03 INSTALLATION

- A. Install work in accordance with manufacturer's instructions.
- B. Set and secure custom lockers in place, assuring that they are secure, rigid, plumb, and level, aligned straight with no distortions.
 - 1. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 8'-0" for plumb, level and with no variations in flushness of adjoining surfaces.
 - 2. Install so that doors are accurately aligned. Adjust hardware to center doors in openings and to provide unencumbered operation.

- C. Use concealed joint fasteners to align and secure adjoining locker units. Cover screw heads with plastic caps to match locker interior finish.
- D. Secure lockers to wall and floor using appropriate anchorages. Minimum pullout force shall be 100 pounds.
- E. Install end panels, filler panels, tops and bases as indicated on approved shop drawings.

3.04 ADJUSTING

- A. Repair damaged and defective components where possible to eliminate defects functionally and visually; where not possible to repair, replace components. Adjust joinery for uniform appearance.
- B. Adjust moving or operating parts to function smoothly and correctly.

3.05 CLEANING

- A. Clean exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Countertops for architectural cabinet work.

1.02 RELATED REQUIREMENTS

- A. Section 06 20 00 - Finish Carpentry
- B. Section 08 56 53 - Security Windows

1.03 REFERENCE STANDARDS

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition.
- B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards.
- C. NEMA LD 3 - High-Pressure Decorative Laminates.
- D. PS 1 - Structural Plywood.

1.04 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. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.

1.05 QUALITY ASSURANCE

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

1.06 DELIVERY, STORAGE, AND HANDLING

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

1.07 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.01 COUNTERTOPS

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

- 1) Arborite; []: www.arborite.com/#sle.
- 2) Formica Corporation; []: www.formica.com/#sle.
- 3) Lamin-Art, Inc; []: www.laminart.com/#sle.
- 4) Panolam Industries International, Inc; []: www.panolam.com/#sle.
- 5) Wilsonart; []: www.wilsonart.com/#sle.
- 6) Substitutions: See Section 01 60 00 - Product Requirements.
- b. Finish: Matte or suede, gloss rating of 5 to 20.
- c. Surface Color and Pattern: As selected by Architect from the manufacturer's standard line.
2. Exposed Edge Treatment: Hardwood nosing as indicated on drawings, natural spar varnish finish; back and end splashes with square top covered with matching laminate.

2.02 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. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

2.03 FABRICATION

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
 1. Join lengths of tops using best method recommended by manufacturer.
 2. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.

3.02 TOLERANCES

- A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.

3.03 CLEANING

- A. Clean countertops surfaces thoroughly.

3.04 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

PART 1 – GENERAL

1.01 SCOPE

- A. The Elevator Contractor shall furnish, install, and provide all work required to complete the Elevator Modernization as stated in the Contract Documents for one (1) existing Esco hydraulic passenger elevator. Project also includes all requirements of Firefighters' Emergency Operation, Seismic, and The Americans with Disability Act (ADA). The project location: Clatsop County Courthouse, 749 Commercial Street, Astoria, OR 97103.
- B. Applicable Documents:
 - 1. ICC/ANSI A117.1 (latest adopted edition) - Accessible and Usable Buildings and Facilities, and the equivalent State of Oregon Codes, State of Oregon whichever are more stringent.
 - 2. ASME A17.1/CSA B44 (latest adopted edition) - Safety Code for Elevators and Escalators including Elevator Safety Requirements for Seismic Risk Zone 3 or Greater and applicable State of Oregon Amendments.
 - 3. ASME A17.2 (latest adopted edition) - Guide for the Inspection of Elevators, Escalators and Moving Walks.
 - 4. ASME A17.3 (latest adopted edition) - Safety Code for Existing Elevators and Escalators and applicable Oregon (OR) Amendments.
 - 5. ASME A17.7/CSA B44.7 (latest adopted edition) - Performance-based Safety Code for Elevators and Escalators.
 - 6. National Electrical Code - (NEC) NFPA 70 (latest adopted edition).
 - 7. National Fire Code NFPA-13 (latest adopted edition).
 - 8. International Building Code - (IBC) current edition that is in effect.
 - 9. ASTM A167 - Steel, Sheet Stainless.
 - 10. ASTM A366 - Steel, Sheet, Carbon, Cold Rolled, Commercial Quality.
 - 11. AWS D1.1 - Structural Welding Code - Steel.
- C. Definitions:
 - 1. AHJ: Regulatory Authority Having Jurisdiction. Oregon State Elevator Section.
 - 2. MCP: Maintenance Control Program.
 - 3. ASME: American Society of Mechanical Engineers.
 - 4. NFPA: National Fire Protection Association.
 - 5. NRTL: Nationally Recognized Testing Laboratory.
- D. Terms:
 - 1. Where, "as shows", "as indicated", "as detailed", or words of similar meaning are used, it shall be understood that reference to the Specifications are made unless otherwise stated. Where "as directed", "as required", "as authorized", "as reviewed", "as accepted", or words of similar meaning are used, it shall be understood that the direction, requirement, permission, authorization, review, or acceptance of consultant is intended, unless otherwise stated.
 - 2. When used in the Contract Documents, "provide" shall be understood to mean "provide complete, furnish and install".
 - 3. Terms used are defined in the latest edition of the Safety Code for Elevators and Escalators, ASME A17.1-2010/CSA B44-10. Any reference to Code in the technical sections shall refer to ASME A17.1-2010/CSA B44-10 unless otherwise noted.
 - 4. Reference to a device or a part of the equipment applies to the number of devices or parts required to complete the installation.
- E. Permits and Codes:
 - 1. All equipment and modernization work shall comply with requirements of the Elevator Safety Code, and other applicable codes of the State of Oregon.
 - 2. Give necessary notices, obtain licenses and permits, and pay fees and other costs, including making arrangements for all inspections and tests required by regulating agencies, in accordance with this elevator specification.

3. File necessary plans, prepare documents, and obtain necessary approval of governmental departments having jurisdiction and required certificates of inspection for work, in accordance with the elevator specification.
4. Elevator Contractor is not relieved from furnishing and installing work shown or specified which may be beyond requirements of Ordinances, Laws, Regulations and Codes.
5. Elevator Contractor shall furnish, provide and install all equipment to comply with all Codes, Regulations and Rules for the completion of this elevator modernization and shall complete all items required by the State of Oregon, or State of Oregon Elevator Inspector at no additional cost to the Owner.

1.02 MODERNIZATION REQUIREMENTS

A. Additional Work Required by General Contractor:

1. Provide machine room mechanical ventilation (HVAC) to maintain temperature at not more than ninety-five degrees Fahrenheit (95° F), for ninety-five percent (95%) of the time, unless a lower temperature is specified by the elevator equipment manufacturer.
2. Lighting:
 - a. Provide LED illumination in the Machine Room sufficient to meet code requirements, currently a minimum of 19 fc.
 - b. Provide LED illumination in the elevator Pit sufficient to meet code requirements, currently a minimum of 10 fc.
3. Provide one (1) 15A-120VAC car lighting fused circuit lockable disconnect in the elevator Machine Room.
4. Provide GFCI receptacles in elevator Machine Room and Pit.
5. Provide one (1) 20A-120VAC fused circuit and receptacle in Pit for sump pump.
6. Provide conduit for phone line from machine room j-box to elevator controller. Elevator Contractor to provide labor/material to hook up the telephone wires from J-box to new elevator controller. Owner to provide phone line to elevator machine room.
7. Patch and fire stop all Machine Room wall penetrations.

B. Work Included by Elevator Contractor:

1. Furnish, provide and install car station, hall stations, controller/selector, electrical wiring in machine room/car/hoistway, car door operator, car top inspection station, hoistway interlocks/door gibs, Firefighters' Emergency Operation, all requirements of the Americans with Disability Act (ADA) and all other elevator components as listed in this Elevator Specification.
2. Retain existing car speed, capacity, and elevator entrance size.
3. Coordinate with Owner to provide safe access to hoistway for work by others.
4. Connect fire recall systems to elevator controls and test.
5. Connect phone line to new elevator controls and test.
6. Provide building protection of access ways and surrounding work areas, including floors.
7. Repair any damage caused by elevator work activities.
8. Provide pedestrian traffic control signage and correspondence.
9. It is assumed public restrooms are available for construction workers. If not Elevator Contractor to provide and maintain portable restrooms. Location to be determined if necessary.
10. Elevator Contractor will provide dumpster for disposal of material if needed.
11. Owner shall incur no extra cost for the Elevator Modernization as stated in the elevator specifications. Elevator Contractor shall provide any and all overtime work in order to complete the total Elevator Modernization on schedule. Cost, if any, to Owner for the above stated items shall be included in Base Bid.
12. All existing elevator equipment that is being retained/reused shall be placed in as-new operating condition by the Elevator Contractor at no extra cost to Owner.
13. Elevator Contractor must provide a detailed schedule of the Modernization Project within 2 weeks of contract award.

C. Cutting and Patching:

1. All repairs shall be made as necessary to complete the entire Elevator Modernization in original condition, including all cutting, fitting, and drilling of masonry, concrete, metal and other materials as specified or required for proper assembly, fabrication, installation and completion of all Work under the Contract, and including any patching and redecorating as may be necessary. This includes all work in the elevator machine rooms, hoistways, Pits, cars, guide rails brackets/fastenings, lobby hall stations and all other areas of the Elevator Modernization.
2. Any provision that requires facilitating removal of existing equipment and installation of new equipment in the machine rooms, lobbies, Pits, hoistways, cabs and repair thereof shall be the total responsibility of Elevator Contractor.
3. All holes/cracks in the hoistways shall be sealed. All hoistway sides of the hall station boxes shall be sealed with Fire Retardant material.

D. Main Line Electrical Power Requirements:

1. Elevator Contractor shall verify, in writing, of their Electrical Power Requirements. Bidders shall verify that the main and auxiliary power feeders are adequately sized and designed for reuse within the modernization program. If the bidder fails to provide this information, any changes and /or upgrades shall be the responsibility of the Elevator Contractor. This information shall be submitted with the Elevator Contractors Bid.

E. Welding:

1. All welding shall comply with ASME A17.1-2010/CSA B44-10 Design for welding, repair, cutting or splicing of members upon which the support of the car, shall be prepared by a licensed professional engineer.
2. Welding shall be by welders qualified in accordance with the requirements of Section 5 of ANSI/AWS D1.1.
3. At the option of the Elevator Contractor, the welders may be qualified by one of the following:
 - a. The manufacturer.
 - b. A professional consulting engineer.
 - c. A recognized testing laboratory.
4. Elevator Contractor shall furnish all required documentation before starting the Elevator Modernization.

F. SDS Information:

1. Elevator Contractor shall provide Owner and Consultant with Safety Data Sheets for products Elevator Contractor intends to employ under this Contract prior to commencement of the Elevator Modernization. It shall remain the responsibility of Elevator Contractor to inform and train Elevator Contractor's employees on the use of the SDS requirements.

1.03 MATERIAL AND EQUIPMENT

A. General:

1. Material and equipment shall be new, of the best quality used for the purposes in good commercial practice, the best of their respective kinds, and as specified. Where two or more units of the same class of equipment are required, those units shall be products of a single manufacturer. Furnish equipment complete with all parts necessary for proper operation. Material and equipment shall be cleaned, free of corrosion, and selected to provide quiet operation.
2. Type capacity, size and rating of all equipment shall be as indicated herein specified.

B. Delivery and Storage:

1. Material and equipment shall be suitably protected against corrosion, dirt, mechanical damage, weather, and chemical damage before and during modernization as recommended by the manufacturer and as approved by the Owner. Replace defective and damaged equipment and materials.

2. All existing elevator equipment that is not being retained shall be removed from the jobsite by the Elevator Contractor at the sole cost to the Elevator Contractor. This includes all existing machine room, hoistway and car elevator equipment.
3. Elevator Contractor shall provide secure lay-down area for elevator equipment. If equipment is to be stored outside Elevator Contractor is responsible to provide weather protection. Location to be determined if necessary.
- C. Elevator Contractor shall verify exact distances between points shown on their shop drawings by actual measurements at the site. This includes fit and finish of hall fixtures and lanterns covering existing cutouts.
- D. Standard Products:
 1. Unless otherwise indicated, the equipment to be furnished under these specifications shall be the standard products of manufacturers regularly engaged in the production of such equipment.
 2. Apparatus, equipment, and systems furnished must be similar and equal thereto with respect to quality, functional performance, capacity and efficiency.

1.04 SUBMITTALS

- A. Shop Drawings:
 1. Submit Shop Drawings for approval. The Shop Drawings shall contain detailed information to determine that the equipment conforms to the requirements of this Specification and not less than the following information:
 - a. Plan view of the elevator machine room. Show location of machinery and controls in machine rooms,
 - b. Include all clearance dimensions required by the Elevator Safety Code.
 - c. The elevator equipment is to be arranged in a neat and professional manner so that all elevator equipment is readily accessible.
 - d. Submit layout drawings as required by the Authority Having Jurisdiction (AHJ). Submittals to the AHJ shall have all information pertinent to the Elevator Modernization to determine whether the Elevator Modernization complies with all applicable Codes.
 - e. Provide Shop Drawings and catalog cuts for all Elevator Contractor furnished material and equipment, including but not limited to doors, car enclosure, car and hall fixtures, controls and motors.
 - f. Complete information on motor, electrical services, controls, and all other coordination information.
- B. Wiring Diagrams, Maintenance Manuals:
 1. Wiring Diagrams:
 - a. Provide complete "As Built and Installed" straight-line wiring diagrams showing the electrical connections, functions, and sequence of operation of all apparatus connected with the elevator, in the machine room, hoistway and car.
 - b. Provide one (1) electronic copy.
 - c. Furnish one complete draft electronic set for Architect and Elevator Consultant. Review not later than one (1) week before issue of the permanent Oregon State Elevator Operating Permit.
 2. Modernization Data:
 - a. Provide "As Built and Installed" wireman's original pull sheets showing raceway, junction box, traveling cable wire nomenclature and origination and termination locations.
 - b. Provide a legible copy of the elevator adjuster's final control settings, such as feet per minute, door open, door close, car door nudging time, door dwell times and all other adjustable features and/or timers.
 3. Operations and Maintenance Manuals:

- a. Furnish one (1) complete hard copy Operation and Maintenance Manual covering the stipulated mechanical systems and equipment. The manual shall comply with all requirements indicated in the Project Closeout section of the Specifications.
- b. Furnish one (1) complete electronic draft manual for Elevator Consulting Services Inc. review not later than one (1) week before issue of the permanent Oregon State Elevator Operating Permit.
- c. The manual shall be complete in all respects for all equipment furnished and installed, controls, accessories and appurtenances stipulated. Include as a minimum the following:
 - 1) Machine room drawing showing equipment location of controller, machine, transformer, governor, main line electrical disconnects, machine room light switch.
 - 2) The original factory Adjustor's Manual used to adjust the specific modernization including "As Built, As Installed and As Adjusted" field notes.
 - 3) Step-by-step procedure for elevator start-up, operation and shutdown.
 - 4) Maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides for all elevator equipment.
 - 5) Preventive maintenance schedule.
 - 6) Lubrication schedule including type, grade, temperature, range and frequency.
 - 7) Safety precautions, including diagrams and illustrations as needed for clarity.
 - 8) All testing procedures, including no-load, full-load safety tests, Seismic and Firefighter's Service.
 - 9) Parts list, with manufacturers' names and catalog numbers. Lists shall be complete for the materials installed.
 - 10) Serial number of all equipment furnished and installed.
 - 11) Service organizations and sources of replacement parts with company names, addresses, fax and telephone numbers.

1.05 ELECTRICAL

- A. Provide electrical components of the elevator equipment and systems, including motors, motor starters, controllers, control instruments, switches, conduit, wire and relays as specified herein and as necessary for complete and operable systems.
- B. Furnish interconnecting wiring for components of equipment as an integral part of the equipment.
- C. Electrical equipment and wiring shall conform to NFPA 70 - National Electrical Code, current adopted edition.
- D. For equipment with electrical components, provide an NRTL label on each component for which published standards exist.
- E. The frames of all motors, pump unit, controller, transformers, and the metal enclosures for all electrical equipment in or on the car, hoistway and machine room shall be grounded in accordance with NFPA 70-Article 250.
- F. Provide "daisy chain" electrical grounding for all machine room electrical cabinets.
- G. Provide required and adequate electrical wiring gauge sizing and number of electrical conductors to eliminate any voltage/ampere drop/variation for all the machine room equipment, hoistway switches; door interlocks; car operating fixtures; positions indicators; exhaust fan; car lighting; inspection station; leveling devices, hall stations; position indicators, and all other elevator electrical equipment.
- H. Provide power transformer.
- I. Conductors and Connections:
 1. Provide new wiring in machine room, hoistway and car. Copper throughout with individual wires coded and connections on identified studs or terminal blocks.

2. Use no splices or similar connections in wiring except at terminal blocks, control cabinets, and junction boxes.
 3. Provide 10% spare wires in all wiring runs. Separate and mark all spare wires. All spare wire ends shall be turned back or protected against accidental exposure to any live electrical circuit or electrical ground.
 4. Provide all material and labor to connect machine room telephone wires to elevator controller and to the in-car emergency telephone. Owner to provide telephone wires to elevator machine room. All wiring shall be enclosed in EMT.
- J. Conduit and Raceway:
1. Provide new painted or galvanized steel conduit (EMT) and duct. Conduit size, one-half (1/2") minimum.
 2. Do not use flexible conduit exceeding thirty-six inches (36") in length.
 3. Flexible heavy-duty service cord may be used between fixed car wiring and car door switches for door protection devices.
 4. Plastic wire ties shall not be allowed for conduit fastening.
- K. Traveling Cables:
1. Traveling cables shall comply with NFPA 70, Article 400.
 2. Provide new with flame and moisture-resistant outer cover.
 3. Traveling cables shall terminate in the elevator machine room controller and on the elevator car top junction box with marked terminals.
 4. Prevent traveling cables from rubbing or chafing against hoistway or elevator equipment within hoistway.
 5. Provide ten percent (10%) spare conductors in each traveling cable.
 6. Provide one (1) spare coaxial traveling cable.
 7. Provide four (4) spare pair of twisted/shielded conductors in traveling cables.
 8. Provide two (2) spare pair of number fourteen (#14) conductors.
 9. All spare wire ends shall be turned back or protected against accidental exposure to any live electrical circuit or electrical ground.
 10. Tag all spare conductors indicating termination points at each end. Provide all wiring for car lighting, fan and emergency communication from elevator controller to car.
 11. Provide traveling cable for in-car lighting, fan, and emergency communication device to elevator machine room.

1.06 PAINTING

- A. All exposed metal elevator components furnished in these specifications, except as otherwise specified, shall be properly painted after modernization. If retained equipment is already painted cleaning and touch up paint only, same color as existing.
- B. Paint elevator Machine Room and elevator Pit floors gray enamel.

1.07 LIGHTING

- A. All lights in car and operating fixtures shall be LED.

1.08 PROJECT CLOSEOUT

- A. Final Cleaning:
 1. Elevator hoistway and equipment shall be cleaned and free from rust, rubbish, loose plaster, mortar drippings, extraneous construction materials, dirt and dust at the end of each workday.
 2. Care shall be taken by workers not to mark, soil, or otherwise deface existing surfaces. In the event that finished surfaces become defaced, clean and restore such surfaces to the original condition at the total cost of Elevator Contractor.
 3. Clean areas in which painting and finishing work is to be performed just prior to the start of this Elevator Modernization and maintain these areas in a clean condition.

4. Cleaning includes the removal of rubbish, broom cleaning of floors, the removal of any plaster, mortar, dust and other extraneous materials from finish surfaces, and surfaces that will remain visible after the Elevator Modernization is complete.
5. Clean car, entrances, operating, signal fixtures and all elevator equipment of dirt, lint, oil, grease, and finger marks.

1.09 WARRANTY

- A. Warrant the completed elevator in accordance with Oregon State law and regulation, but in no case less than complete coverage of parts and labor for one (1) year after issue of the State of Oregon elevator operating permit.

1.10 WARRANTY MAINTENANCE

- A. Maintenance Control Program (MCP)
 1. Provide an MCP for the elevator. The MCP shall include, but is not limited to the following:
 - a. Examinations, maintenance, and tests of equipment at scheduled intervals in order to ensure that the installation conforms to the requirements of ASME A17.1/CSA B44 Section 8.6. The maintenance procedures and intervals shall be based on:
 - 1) Equipment age, condition, and accumulated wear
 - 2) Design and inherent quality of the equipment
 - 3) Usage
 - 4) Environmental conditions
 - 5) Improved technology
 - b. The manufacturer's recommendations for any SIL rated devices or circuits
 - c. Cleaning, lubricating, and adjusting applicable components at regular intervals and repairing or replacing all worn or defective components where necessary to maintain the installation in compliance with the requirements of ASME A17.1/CSA B44 Section 8.6.
 2. The instructions for locating the Maintenance Control Program shall be provided in or on the controller along with instructions on how to report any corrective action that might be necessary to the Owner.
 3. The maintenance records required shall be kept at a central location agreeable and accessible to the Owner and the Elevator Contractor's elevator personnel.
 4. The Maintenance Control Program shall be accessible to the elevator personnel and shall document compliance with ASME A17.1/CSA B44 Section 8.6.
 5. Procedures for tests, periodic inspections, maintenance, replacements, adjustments, and repairs for all SIL rated E/E/PES electrical protective devices and circuits shall be incorporated into and made part of the Maintenance Control Program.
 6. Where unique or product-specific procedures or methods are required to inspect or test equipment, such procedures or methods shall be included in the Maintenance Control Program.
- B. Elevator Contractor shall provide WARRANTY FULL-SERVICE PREVENTIVE MAINTENANCE service for a period of one (1) year after the elevator is accepted by the State of Oregon Elevator Inspector, Owner, Elevator Consultant and all punchlist items have been completed and elevator is available for unconditional use by the Owner.
- C.
 1. Elevator Contractor shall provide, at a minimum, once per quarter Warranty Preventive Maintenance visits to the elevator, for the one (1) year period.
 2. Total minimum Preventive Maintenance Hours shall be per required to effectively comply with MCP. This does not include any time for Repairs, Callbacks, or Testing.
 3. Elevator Contractor shall furnish written reports of each service call, whether routine or emergency, describing services performed.
 4. Basic service work shall be performed during regular working hours of regular working days.

- a. Emergency callback service shall be available on a twenty-four (24)-hour, seven (7)-day basis at no additional cost to the Owner.
 - b. Owner will not be charged for travel time or mileage for callback service
5. Elevator Call Back Response Time shall be as follows: After call is placed from Owner to Elevator Contractor and received by Elevator Contractor's Dispatching service and until the Elevator Contractor's serviceperson is at the reported elevator:
 - a. Person trapped in elevator-all hours-all days = 30-45 minutes.
 - b. Elevator Trouble Call-Monday thru Friday-8:00 am to 5:00 pm = 2 hours.
 - c. Elevator Trouble Call-Monday thru Friday-off hours, 5:00 pm to 8:00 am = 4 hours.
 - d. Elevator Trouble Call-Saturdays, Sundays and Holidays-all hours = 4 hours.
6. In performance of this Work, Contractor agrees to carry out all Work in strict compliance with all laws, Codes, rules and regulations set forth with regard to the equipment by municipal, state or federal authorities having jurisdiction in effect on the date of this contract.
7. Elevator Contractor shall protect all adjacent equipment, surfaces, etc. from damage and shall make good any damage thereto at Elevator Contractor's own expense.
8. Elevator Contractor shall clean up all Work areas and shall remove from the premises all debris resulting from Elevator Contractor's operations.
9. Elevator Contractor's service and repair personnel shall wear uniforms identifying them as employees of Elevator Contractor for ease of identification by Owner.
 - a. Elevator Contractor is to enforce strict discipline and order among their employees while on Owner's premises and shall be subject to the rules and regulations established by Owner.
 - b. Personnel deemed unacceptable by Owner, for any reason, will not be allowed to perform Work under this contract with Owner.
10. Keys:
 - a. Elevator Contractor will be issued keys for the elevator machine room. Duplication of any Owner key is not allowed.
 - b. Any and all costs occurring due to the loss of keys by Elevator Contractor, including the changing of locks, shall be borne at the sole cost and expense of Elevator Contractor.
11. All labor furnished by Elevator Contractor shall be trained elevator mechanics, thoroughly skilled in elevator maintenance and directly employed and supervised by Elevator Contractor.
 - a. They will use all reasonable care to maintain the elevator equipment in a proper and safe operating condition and to extend the life of the equipment.
12. Maintain the hoistway, Pit, machinery, machinery room and any assigned Elevator Contractor Workspace in a clean, orderly condition, free of dirt, dust, oil and grease spills, trash and debris, at all times.
13. Replace burned out indicator lamps in cars and hall call stations during Preventive Maintenance visits.
14. Elevator Contractor shall conduct the following tests and any other tests required:
 - a. All tests required by the State of Oregon Elevator Inspection Department.
 - b. Written reports of these tests shall be submitted to Owner within five (5) days from completion and also as required to the Elevator Inspector. Seven (7) days prior notification shall be given so that a representative of Owner may witness said test or tests.
 - c. Elevator Contractor shall perform all required Firefighter's Service tests and maintain all required documentation. Written results of such testing shall be submitted to Owner one (1) week after such testing.
15. Elevator Contractor shall post a Preventive Maintenance Schedule and Work Log in the machine room.
 - a. The log shall include all entries for routine maintenance and repairs.

- b. Entries shall include date Work is completed, brief description of Work completed and the Mechanic's name.
 - c. Owner may review and copy the log and maintenance schedule at any time.
 - d. Elevator Contractor's Preventive Maintenance Schedule and Work Log shall be submitted with the Modernization Bid.
16. Elevator Contractor shall maintain a complete set of wiring diagrams showing "as built" conditions with any changes or modifications to circuits resulting from control modifications, parts replacement or equipment upgrade.
- a. Owner retains sole possession of these wiring diagrams.
 - b. The wiring diagrams shall be kept in a neat and orderly fashion and be located in the machine room.
17. Elevator inspection fees shall be paid by Owner. Fees for re-inspection due to failure to eliminate deficiencies, which are the responsibility of Elevator Contractor, shall be paid by Elevator Contractor.
18. EXCLUSIONS:
- a. Repairs required because of negligence, accident or misuse of the equipment by anyone other than Elevator Contractor, their employees, subcontractors, agents or other causes beyond Elevator Contractors control except ordinary use.
 - b. Repairs and replacement pertaining to the car enclosure including removable panels, door panels, car doors, suspended ceilings, light fixtures, tubes and bulbs for general lighting, handrails, car finish, and flooring coverings, hoistway enclosure, hoistway entrance frames and sills and emergency telephone instruments.
 - c. Mainline power disconnect switches and breakers, fuses and feeders to the switches.
 - d. Elevator Contractor shall not be required, under this agreement, to install new attachments or devices, after the elevator is accepted by Elevator Inspector, Elevator Consultant and Owner, as may be recommended or directed in the future by insurance companies, federal, state, municipal or governmental authorities unless compensated for such installation. This applies to possible changes in the ASME A17.1/CSA B44 Elevator Code.
19. All Work to be performed, which is not included in this One Year Warranty Period, shall be authorized by Owner by written notification to Elevator Contractor prior to commencement of the Work. The hourly rates and material mark up from cost will be as follows:

	Mechanic	Helper	Crew
Straight Time	\$230.00	\$200.00	\$430.00
Straight Time + 70%	\$280.00	\$235.00	N/A
Double Time	\$300.00	\$255.00	\$555.00

MATERIAL MARKUP: 15%

1.11 QUALITY ASSURANCE

- A. Elevator Contractor shall furnish Owner with all special tools, meters, diagnostic tools/devices, troubleshooting special hand-held tools/devices, printed information, adjusting information and all other special tools/devices/laptops to perform maintenance, troubleshooting, repairing and adjusting at conclusion of elevator modernization. If any special tool, meter, diagnostic tools/device/laptop requires readjusting or re-programming Elevator Contractor shall pay for all costs including freight for a period of five (5) years from date of elevator final acceptance by Owner and Elevator Consulting Services, Inc. Cost, if any, to Owner for the above stated items shall be included in Base Bid. After the initial five (5) year period all upgrades, readjustments or reprogramming of any or all diagnostic tools or devices will be provided as needed or required on a purchase order basis with the original Elevator Contractor that installed/manufactured the elevator equipment with the Owner.
- B. Elevator Contractor shall provide and install all software improvement up-grades for a period of five (5) years from date of elevator final acceptance by Owner, State of Oregon Elevator

Inspector and Elevator Consulting Services, Inc. The upgrades are defined as improvements for the elevator operation. If any elevator safety software up-grades are designed or discovered by the elevator manufacturer, the up-grades shall be installed immediately. All costs of the software up-grades shall be paid by Elevator Contractor.

- C. Elevator Contractor shall provide the Owner the ability to purchase and receive all elevator replacement parts within twenty-four (24) hours from date of parts order by Owner. Replacement and spare parts are defined as any and all items required to maintain, service, repair, adjust and operate the elevator as designed and installed, in a safe and trouble-free manner. Elevator Contractor shall sell any and all spare parts including proprietary parts to the Owner during the entire life cycle of the elevator equipment.
- D. Elevator Contractor shall supply a list, in writing, of all proprietary equipment that will be provided. A list of these items shall be provided together with a guarantee of availability. This guarantee shall specify that all proprietary parts shall be available for the life of the elevator equipment and within a twenty-four (24) hour period of order placed. Owner may return the worn or defective part to Elevator Contractor after the replaced part is delivered to the Owner and the elevator has been placed in normal operation. Elevator Contractor shall submit a list of all proprietary equipment that is required in the elevator drive and control system. The list shall include individual item cost and part numbers or coding. Parts ordering information shall be provided.

1.12 ACCEPTABLE ELEVATOR INSTALLERS/MANUFACTURES

- A. Acceptable Elevator Manufacturers
 - 1. Controls:
 - a. Motion Control Engineering, Inc.
 - b. Elevator Controls Company
 - c. Smartrise Engineering, Inc.
 - d. Otis Elevator Company
 - e. TK Elevator Company
 - f. KONE Elevator Company
 - g. Or approved equal
 - 2. Power Unit, Limit Switches:
 - a. Canton Elevator Company
 - b. EECO-Elevator Equipment Company, Inc.
 - c. Minnesota Elevator, Inc.
 - d. Otis
 - e. TK
 - f. KONE
 - g. Or approved equal
 - 3. Hydraulic Valve:
 - a. Maxton Manufacturing Company
 - b. EECO-Elevator Equipment Company, Inc.
 - c. Or approved equal
 - 4. Muffler:
 - a. MEI gas charged muffler
 - b. Or approved equal
 - 5. Roller Guides:
 - a. ELSCO Model "B"
 - b. Or approved equal
 - 6. Car Door Operator:
 - a. G.A.L. Manufacturing Corporation-MOVFE-Linear
 - b. Otis Linear
 - c. KONE Linear
 - d. TK Linear

- e. Or approved equal
- 7. Car Door Clutch, Pick-Up Rollers:
 - a. G.A.L.
 - b. Otis
 - c. TK
 - d. KONE
 - e. Or approved equal
- 8. Car Door:
 - a. Otis
 - b. TK
 - c. KONE
 - d. Or approved equal
- 9. Door Interlocks, Gate Switch:
 - a. G.A.L. Manufacturing Corporation
 - b. Otis
 - c. TK
 - d. KONE
 - e. Or approved equal
- 10. Hoistway Door Closers
 - a. SmarTork, Inc.
 - b. No approved equivalent
- 11. Car Door Protective Device (3D):
 - a. Janus "Panachrome-3D"
 - b. Or approved equal
- 12. Fixtures-Vandal Resistant:
 - a. Hall Stations (Flush mount, field measured and verified to cover existing cutouts):
 - 1) Innovation Industries Incorporated "The Bruiser Vandal Resistant"
 - 2) Otis Vandal Resistant
 - 3) TK Vandal Resistant
 - 4) KONE Vandal Resistant
 - b. Car Fixtures, including Directional Lanterns:
 - 1) Innovation Industries Incorporated "The Bruiser-Vandal Resistant"
 - 2) Otis Vandal Resistant
 - 3) TK Vandal Resistant
 - 4) KONE Vandal Resistant
 - 5) Or approved equal
- 13. Car Position Indicators/Signals:
 - a. C.E. Electronics, Inc.
 - b. Or approved equal
- 14. ADA Phone:
 - a. Electronic Microsystems (EMS)
 - b. Rath
 - c. Or approved equal
- 15. Alarm Bell:
 - a. Nylube Model ELB-6
 - b. Or approved equal
- 16. Cab Lighting:
 - a. Man-D-Tec Solobeam
 - b. No approved equivalent
- 17. In-Car Emergency Light:
 - a. Nylube Products Model EL-SS
 - b. Or approved equal

PART 2 – PRODUCTS

2.01 GENERAL

- A. The completed elevator modernization shall conform to the Elevator Safety Code except as specifically otherwise indicated or specified. The elevator modernization, including equipment, material, workmanship, design, and tests shall be in accordance with the standards, rules and Specifications referenced. All material and equipment shall be new. Electrical materials shall meet and bear evidence of meeting the requirements of Underwriter's Laboratories. The equipment shall be the product of a manufacturer regularly engaged in the manufacture and modernization of this type of equipment. Working parts shall be accessible for inspection, servicing and repair. Adequate means shall be provided for the lubrication of all wearing parts that require lubrication.
- B. DESCRIPTION AND PERFORMANCE: Modernization will be in accordance with the following details and consist of the following (speed, travel, capacity, and door configuration shall remain the same):

Original Manufacturer:	Esco
Year Installed:	1981
Building ID:	#1
State ID:	PXH-7812
Control System:	Simplex
Door Type:	Single Speed, Center Opening
Door Size:	3' 6" Wide X 7' 0" Tall
Landings:	3
Floor Designations:	BP, *1, 2
Capacity:	2,500 LBS
Car Weight:	2,911
Rated Speed:	100 FPM
Machine Room Location:	Bottom Landing, Adjacent
Disconnect (Amps/VAC)	100AMP/240VAC

2.02 GENERAL MATERIALS

- A. Steel:
1. Sheet Steel-Furniture Steel for Exposed Work: Stretcher-leveled, cold-rolled, commercial-quality carbon steel, complying with ASTM A1008, matte finish.
 2. Sheet Steel for Unexposed Work: Hot-rolled, commercial-quality carbon steel, pickled and oiled, complying with ASTM A569.
 3. Structural Steel and Plates: ASTM A36 AND ASTM A108.
- B. Stainless Steel:
1. Type 302 or 304 with standard tempers and hardness required for fabrication, strength and durability.
 2. Apply mechanical finish on fabricated Work in the locations shown or specified. Federal Standard and NAAMM nomenclature, with texture and reflectivity required matching sample. Protect with adhesive-paper covering until final inspection.
 3. Bright directional polish (satin finish). Graining directions as shown or, if not shown, in longest dimension.
- C. Aluminum:
1. Extrusions per ASTM B221; sheet and plate per ASTM B209.
- D. Plastic Laminate: ASTM E84 Class A and NEMA LD3, Fire-Rated Grade (FR-50), Type 7, 0.050" +/- .005" thick; color and texture as follows:
1. Exposed surfaces: Color and texture selected by Owner during submittals.

2. Concealed surfaces: Manufacturer's standard color and finish.
- E. Fire Retardant-Treated Particleboard Panels:
 1. Minimum 3/4" thick backup for natural finished wood and plastic laminate veneered panels, edged and faced. Provide with suitable anti-warp backing; meet ASTM E84 Class "I" rating with a flame-spread rating of 25 or less.
- F. Baked Enamel:
 1. Apply factory applied baked enamel in the selected solid color.

2.03 POWER AND CONTROL DEVICES

- A. Simplex Automatic Operation:
 1. Automatic operation by means of a car button in the car for each landing served and an up and down button at each landing except for the terminal landings that shall have only one button.
 2. When elevator is idle, automatically start car and dispatch it to floor corresponding to registered car or hall call. Slow down and stop car automatically at floor corresponding to registered call.
 3. As slowdown is initiated for a hall call, automatically cancel the call and render the hall button for that direction of travel ineffective until the car leaves the floor.
 4. Cancel car calls in same manner.
 5. Hold car at arrival floor an adjustable time interval to allow passenger transfer.
 6. Illuminate appropriate button to indicate call registration.
 7. Extinguish light when call is answered.
 8. Program door operating sequence to minimize car and landing door open and close time periods.
 9. Include independent service control where indicated, as follows:
 - a. Provide a switch in the car control cabinet to allow removal of a designated car from service; car to operate in response to car calls only.
 - b. Doors open automatically upon arrival at landing.
 - c. Set landing indicator panels as inoperative when in independent service mode.
- B. Door Operation:
 1. Open doors automatically when the car arrives at a floor to permit transfer of passengers. Automatically close doors after a timed interval.
- C. Automatic Stopping Accuracy:
 1. Two-way automatic leveling feature shall stop the car within 1/4" regardless of load or direction of travel. Landing level will be maintained within the leveling zone irrespective of the hoistway doors being open or closed.
- D. Hydraulic Control System:
 1. The hydraulic control system shall be designed suitable for operation under the required pressure and shall be mounted in the storage tank. The control valve will be a unit type with UP, DOWN and check valve included. All of the functions shall be fully adjustable for maximum smoothness and to meet contract conditions.
 2. A manual-lowering valve will be provided to lower the elevator at slow speed.
 3. The hydraulic valve shall have the capability of providing a smooth, comfortable acceleration, retardation and final stop.
- E. Emergency Car Lighting and Alarm:
 1. Car-mounted, battery unit with solid-state charger to operate alarm bell and lighting, per Code. Battery to be rechargeable with 5-year minimum life expectancy. Provide test button in service cabinet of car station, which causes illumination of standby lighting bulbs.
 2. Emergency lighting fixture shall be integral part of car operating station.
- F. Security:
 1. Provide for capability of proximity reader security for both hall calls and car calls.

2. Interface any security devices with new controls.
- G. Sleep Mode:
 1. Provide function that will shut off cab lights and fan after elevator sits unused for a determined of time (typically 5 minutes). Time shall be adjustable.

2.04 MACHINE ROOM EQUIPMENT

- A. Controller:
 1. Provide reduced voltage (solid state) motor starting circuits.
 2. Provide Independent Service feature.
 3. Provide viscosity control unit.
 4. Provide battery-lowering device:
 - a. If normal electrical building power is not in operation the car shall close the doors and return to the main lobby and open the doors. All safety circuits shall be monitored.
 - b. Car shall remain out of service until normal electrical building power is restored.
 5. Firefighter's Emergency Operation:
 - a. Operate and recall elevator to designated floor during fire. Provide sensor signal wiring from hoistway or machine room connection point to controller terminals. Operate visual/audible signal until return is complete or automatic operation restored. Provide Phase I key switch with engraved instruction at main recall floor hall station.
 6. Low-Oil Control
 - a. In the event hydraulic oil level is insufficient for travel to the top floor, provide controls to return elevator to the main level and park with car doors open, until oil is added and elevator is manually re-set.
- B. Hydraulic Pump Unit:
 1. Provide new fully assembled "wet type" unit consisting of positive-displacement pump, induction motor, master-type control valves combining safety features, holding, direction, bypass, stopping and manual-lowering functions, shut-off valve, oil reservoir with protected-vent opening, oil gauge and outlet strainer, drip pan and connections all mounted on isolating pads.
- C. Muffler:
 1. A gas charged blowout-proof muffler shall be installed in the discharge oil line near the hydraulic pump unit.
 2. Muffler shall be designed to dampen and absorb pulsation and noise in the flow of hydraulic oil fluid.
- D. Piping and Oil:
 1. Retain existing oil lines.
 2. Replace any Victaulic couplings that are visibly leaking.
 3. Provide "ISO 32 Environmentally Safe" or hydraulic oil recommended for the system by the control valve manufacturer.
 4. Provide isolation couplings between the pump unit and oil line.
- E. Shutoff Valve:
 1. Provide new oil line shutoff valve in the Machine Room.
- F. Noise and Vibration Control:
 1. To minimize noise and vibration, mechanically isolate elevator equipment from the structure, electrically isolate controller and motor.
 2. Limit noise level relating to elevator equipment and its operation to no more than 60 decibels in elevator car under any condition including door operation and exhaust fan on highest speed.
- G. Keys:
 1. Keys Required in Machine Room:

- a. Three (3) sets of keys to operate all keyed switches and locks shall be furnished upon completion.
- b. Keys shall be properly marked with metal or plastic tags. Each tag shall include ¼" letters or numbers as to the function of each key set.

2.05 HOISTWAY & PIT EQUIPMENT

- A. Guide Rails:
 1. Existing guide rails shall be retained.
 - a. Realign guide rails to within one-sixteenth of an inch (1/16") vertical and one thirty-second of an inch (1/32") (DBG) tram.
 - b. File all joints-area to file shall be at least 16" above and 16" below each joint. Power disk sander shall not be allowed to file joints. Flat file that is enclosed in a Rail File Holder shall be the method of filing rail joints.
 2. Replace any missing or broken fastening devices.
 3. Provide bevel washers for any bolt/nut that is installed in a plane of 5 degrees or greater.
 4. Paint guide rails and brackets with one coat of light gray enamel.
- B. Guide Rail Fishplates:
 1. Retain existing.
- C. Spring Buffers:
 1. Retain existing.
 2. Paint with one coat of light gray enamel.
- D. Hydraulic Cylinder/Plunger:
 1. Retain existing.
 2. Provide new packing.
- E. Hydraulic Jack Support:
 1. Retain existing.
- F. Terminal Stopping Devices:
 1. Provide new upper normal terminal stopping devices. Provide switches that will not cause high noise level when activated by car cam.
- G. Pit Stop Switch:
 1. Provide new emergency type stop switch located in the Pit as to be accessible from the hoistway access door, per ASME A17.1/CSA B44. Locate stop switch adjacent to the Pit ladder.
- H. Seismic Safety Valve:
 1. Provide Seismic Safety Valve in oil line in Pit area.
 2. Install Seismic Safety Valve adjacent to hydraulic cylinder inlet-outlet connection.
 3. Provide seal on Seismic Safety Valve after adjusting for correct setting.
 4. Perform five-year full load test and tag valve.
- I. Shutoff Valve:
 1. Retain existing shut off valve in Pit.
- J. Pit Ladder:
 1. Provide new code compliant Pit ladder.

2.06 HOISTWAY ENTRANCES

- A. Frames:
 1. Provide all new mechanically attached floor plates with Braille white on black.
- B. Hoistway Door Panels:
 1. Retain existing hoistway door panels.
 2. Provide two (2) gibs per door panel-one at the leading edge and one at the trailing edge.

3. Provide steel safety retainer plates between each standard door gib. Plate shall span minimum of 4" centered between each standard door gibs. Plates shall vertically penetrate into the hoistway door sill groove the maximum vertical depth without bottoming out on the groove.
- C. Interlocks:
 1. Provide new NRTL rated and approved interlock for each hoistway door entrance.
 2. The interlock shall prevent operation of the elevator unless all doors are in the closed and locked position.
 3. Provide fire rated electrical wires from all interlocks to hoistway electrical riser. The conductors shall be flame-retardant and suitable for a temperature on not less than 392 degrees F. Conductors shall be Type SF or equivalent.
 4. Provide electrical ground wire from each interlock to the elevator controller. Electrical ground wire shall be green colored conductor that connects all interlocks and terminates in the elevator controller at an electrical lug that designates electrical ground as defined by the NFPA-70.
- D. Hoistway Door Closers:
 1. New heavy duty spirator type.
- E. Hoistway Door Tracks & Hangers:
 1. Retain existing.
 2. Clean all tracks and hangers and replace any broken/missing components.
- F. Sight Guards:
 1. Retain existing.
- G. Sills:
 1. Retain existing.
 2. Clean and remove all debris and build-up.
- H. Fascia, and Hanger Covers:
 1. Retain existing. Clean and touch up paint only.
- I. Dust Covers:
 1. Retain existing. Clean and touch up paint only.
- J. Struts:
 1. Retain existing. Clean and touch up paint only.
- K. Headers:
 1. Retain existing. Clean and touch up paint only.

2.07 CAR EQUIPMENT

- A. Car Sling:
 1. Retain existing. Replace any missing or broken components.
- B. Buffer Striking Plates:
 1. Retain existing. Ensure plates are securely mounted to bolster channel.
- C. Platform:
 1. Retain existing platform. Replace any damaged or missing component.
- D. Roller Guides:
 1. Provide new roller guides.
 2. Provide Seismic rated position restraint plates. The clearance between each running face of the guide rail and the position restraint shall not exceed 0.187" and the depth of engagement with the rail shall not be less than the dimension of the side running face of the rail.
- E. Toe Guard:
 1. Retain existing. Paint front with one coat of black enamel.

- F. Car Doors:
 - 1. Provide new car door panels finished in #4 brushed stainless steel.
- G. Car Door Sill:
 - 1. Retain existing.
- H. Car Door Hangers, Rollers, Up thrust and Tracks:
 - 1. Provide new.
- I. Header:
 - 1. Retain existing.
- J. Car Door Electrical Contact:
 - 1. Provide New.
- K. Car Door Clutch:
 - 1. Provide New.
 - 2. Provide door anti-egress device.
- L. Door Operator:
 - 1. Provide new heavy-duty, linear door operator.
 - 2. Car door operator shall mechanically drive the car doors:
 - a. Open doors automatically when car arrives at a floor to permit egress of passengers.
 - b. Close doors automatically after a timed interval.
- M. Door Protective Device:
 - 1. Provide new 3-D proximity-type car door protective device:
 - a. The detection zone moves with the car door so that if a person or object enters the zone after the doors have started to close, the doors shall stop, and then reverse to re-open.
 - b. The doors shall re-close after a scheduled time.
 - 2. Nudging Action:
 - a. If the safety device is obstructed for a predetermined adjustable time (10-30 seconds), sound buzzer and attempt to close doors with a not more than 3.5 J (2.5 ft-lbf) kinetic energy.
 - b. Stop and hold doors during closing if detector zone is entered.
 - c. Allow door to close after obstruction is removed.
- N. Elevator Car Station:
 - 1. Provide one (1) vandal resistant elevator control station with faceplate, consisting of a metal box containing the operating fixtures, mounted behind the non-swing car enclosure front panel.
 - 2. Provide car position indicators, two inches (2") high digital type together with directional arrows located in the top area of the car operating station.
 - 3. Provide emergency lighting unit. Device shall be built in, and part of the front main car operating station at the upper section of the station cover. Device shall provide lighting of .02 ftc at a distance of four feet (4') above the car floor and one foot (1') in front of the car operating station. The emergency lighting shall maintain the light intensity for a period of at least four (4) hours.
 - 4. Provide one eighth of an inch (1/8") raised floor pushbuttons which illuminate to indicate LED call registration.
 - 5. Provide illuminated alarm button at bottom of station to sound distress signal alarm located on the car top. Provide a signal to the elevator controller at a terminal strip for monitoring purposes of alarm at a remote location.
 - 6. Provide keyed stop switch in panel faceplate with markings to show "Run" and "Stop" positions.

7. Provide door open button to stop and reopen closing doors. Make button operable while car is stopped at landing, regardless of special operational features, except Firefighters' Service.
8. Provide one (1) Firefighters' Service Phase II key switch with engraved instructions, light jewel, buzzer and call cancel button. Provide Firefighter's phone jack plug in car station with electrical conductors to elevator controller devices located per ASME A17.1/CSA B44 code.
9. Provide lockable service panel with recessed flush cover plate. Include the following controls, with purpose and operating positions identified by engraved letters painted black.
 - a. Car light switch and emergency light test switch. Test switch shall disconnect the electrical power to the main car lighting circuit.
 - b. Three position fan switch-Low Speed-High Speed-Off.
 - c. Independent service switch to permit selection of independent or automatic operation.
 - d. Start button for closing doors and starting elevator when operating on independent service. Floor pushbuttons may be used for this function.
 - e. Duplex 120 VAC electrical convenience outlet. Provide GFCI protection.
10. Provide black paint filled engraving as follows:
 - a. Elevator number and capacity
 - b. **"Permit on File with Facilities"**
11. Emergency Telephone:
 - a. Emergency communication device shall be mounted as part of the car operating panel.
 - b. Provide all required electrical wiring from the in-car station to the elevator controller.
 - c. Phone shall be mounted such that it is easily removable for servicing.
 - d. Provide all required programming including labor and material for placing device in operation.
12. Faceplate Material and Finish: #4 stainless steel.
- O. Car Top Control Station:
 1. Operating fixture shall be provided containing continuous pressure Up, Down and Safe buttons, emergency stop switch, inspection/run switch, and 110 VAC duplex outlet with GFCI protection.
 2. Toggle switches shall not be provided for the Stop, Run and Inspection switches unless the switches are guarded against accidental activation. Fasten car top station to car crosshead.
- P. Car Top Illumination:
 1. Provide car top work light.
 - a. Rating of light to be sufficient to maintain the illumination required by ASME A17.1/CSA B44.
 - b. The lamp(s) shall be guarded to prevent incidental contact.
 2. Provide an additional light fixture on a 2400 mm (96-in.) flexible cord. Cord to be hard wired into car top fixed work light.
 - a. Provide fixed metal bracket to store cord when not in use. Locate bracket to avoid stepping on cord when attached to bracket.
 - b. The lamp(s) shall be guarded to prevent incidental contact.
 3. On-Off car top light switch shall control both fixtures.
- Q. Exhaust Fan:
 1. Retain existing.
- R. Car Top Emergency Exit:
 1. Provide car top emergency escape hatch to comply with ASME A17.1/CSA B44.

2.08 CAR ENCLOSURES

- A. Car Enclosure:

1. Wall Panels:
 - a. Provide new ½" thick plywood vertical wall panels to 12" below top of cab. Panels, including exposed edges, to be covered with plastic laminate (Owner will chose finish during submittals). All Plywood shall conform to the requirements of ASME A17.1/CSA B44 flame spread index of 0 to 75 and (b) smoke development of 0 to 450.
2. Base:
 - a. Provide new finished in #4 brushed stainless steel.
 - b. New base shall have vent slots for air circulation.
3. Returns:
 - a. Provide new applied "skin" finished in #4 brushed Stainless Steel to cover existing plastic laminate.
4. Reveals:
 - a. Provide new reveals between panels finished in #4 brushed Stainless Steel.
5. Ceiling:
 - a. Provide new suspended ceiling finished in #4 brushed Stainless Steel with six (6) LED downlights.
6. Pad and Pad Hooks:
 - a. Provide Stainless Steel pad hooks on all walls.
 - b. Pad hooks shall be through bolted to cab walls.
 - c. Provide fire retardant pads for rear and side walls with metal grommet holes for the pad hook fastening.
7. Handrails:
 - a. Provide new #4 Brushed Stainless-Steel, 1.5" round handrail on rear wall.

2.09 LANDING CONTROL STATIONS

- A. Pushbuttons:
 1. Provide "Flush Mounted" vandal resistant fixtures at each landing. Include pushbuttons for direction of travel, which illuminate LEDs to indicate call registration. Engrave safety message, "In Case of Fire..." (Ref. ASME A17.1-2010/CSA B44-10, 2.27.9) in pushbutton faceplate and fill black. Center of buttons to be 42" from finish floor.
 2. Provide UP or DOWN markings to the left of each button together with Braille markings. Marking plates shall be built into the cover plates.
 3. Provide Firefighter's Emergency Operation Phase I key switch with engraved instructions at main Recall floor hall station.
 4. Provide visual and audible signals for communication device to comply with ASME A17.1/CSA B44, 2.27.1.1.6 at main recall floor hall station.
- B. Faceplate Material and Finish:
 1. Hall Pushbutton Station: Flush mount #4 Brushed Stainless Steel. Provide vandal resistant Stainless-Steel fastening devices. Must be field measured and verified by elevator contractor so new fixture covers existing cutouts and buttons are placed at code height.

2.10 SIGNALS

- A. Car Traveling Lantern:
 1. Provide Vandal Resistant type in car entrance column. Lantern must be located in opposite column so that it is clearly viewable from hall call station. Provide #4 Brushed Stainless Steel cover plate with vandal resistant Stainless-Steel fastenings. Illuminate appropriate direction light and sound electronic tone as hall call is answered to indicate intended car travel. Tone shall sound once for UP direction, twice for DOWN direction.
- B. Car Position Indicator:

1. Include as integral part of car station. Provide 2" high digital-type indications representing the floor served. Provide a floor passing audible signal. Signal shall be no less than 20 decibels with a frequency no higher than 1500 Hz.
2. Provide blank stainless steel #4 cover plate for existing car position indicator over car door.

PART 3 – EXECUTION

3.01 MODERNIZATION OF ELEVATOR SYSTEMS

- A. General:
1. Comply with manufacturer's instructions and the Elevator Safety Code for work required during modernization.
 2. Before beginning the modernization, the Elevator Contractor shall examine the hoistway and machine room to verify conditions and provide written notice to the Owner of any conditions which would substantially hinder or prevent proper execution of the work. The Elevator Contractor shall not proceed with the modernization until the cited conditions are corrected.
 3. Pre-modernization Meeting:
 - a. Prior to modernization of the elevator equipment, a meeting with the Elevator Contractor, Electrical Contractor, Mechanical Contractor, Construction Coordinator, and Elevator Consultant shall be held to review modernization approach and identify any special circumstances pertaining to this modernization.
 4. Welded Construction:
 - a. Provide welded connections for modernization of elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance and replacement of worn parts. Comply with standards of AWS D1.1 for workmanship and for qualifications of welding operators.
 5. Electrical Work:
 - a. All work shall conform to the requirements of the Elevator Specifications.
 - b. Mark each component, including but not limited to relays, switches, timers, fuses and overload devices, with permanent identification that corresponds with the nomenclature of the wiring diagrams and the operations and maintenance manuals.
 - c. Terminate all field wiring at each control cabinet on terminal strips suitable for the use. Field wiring shall not terminate on the studs of relays or other devices and equipment.
 6. Coordination:
 - a. Coordinate elevator work with work of other Crafts/Trades for proper time and sequence to avoid elevator modernization delays.
 7. Sound Isolation:
 - a. Mount rotating and vibrating elevator equipment and components on vibration-absorption mounts, designed to effectively prevent transmission of vibrations to structure, and thereby eliminate sources of structure-borne noise from elevator system.
 8. Lubrication:
 - a. Lubricate operating parts of systems as recommended by manufacturers.

3.02 FIELD QUALITY CONTROL

- A. Compliance Testing:
1. Upon nominal completion of elevator modernization, and before permitting use of elevator (either temporary or permanent), perform acceptance tests as required and recommended by Code and governing regulations or agencies. Advise Owner and Elevator Consultant and inspection departments of governing agencies, in advance, of dates and times tests are to be performed on elevator. Owner and Elevator Consultant shall be notified seven (7) days in advance of these tests.
 2. Acceptance Tests

- a. Conduct operational test of car within one (1) week of issue of the State of Oregon Permanent Operating Permit.

3.03 PERFORMANCE

- A. Speed
 1. +/- 10% of contract speed under any loading condition in down direction. Rated speed in up direction under any loading conditions.
- B. Stopping Accuracy
 1. +/- Level to 1/4" under any loading conditions or direction of travel.
- C. Door Opening Time: Seconds from start of opening to fully open.
 1. 2 seconds.
- D. Floor-to-Floor Performance Time: Seconds from start of doors closing until doors are 3/4 open and car level and stopped at next successive floor under any loading condition or travel direction.
 1. 20 seconds.
 2. Provide a smooth start, high speed operation and stop in both directions.
- E. Noise Level
 1. The measured noise level in the elevator cab of elevator equipment shall not exceed 60 dB during car operating conditions and a maximum increase of 7 dB during door operation.
 2. Maximum of 75 dB in machine room.
- F. Ride Quality
 1. Horizontal vibration, side to side and front to back with car during normal operation shall not exceed 25 mg in the 1-10 Hz range.
 2. Vertical vibration not more than 20 mg. Provide smooth and constant acceleration and deceleration of not more than 2.8 feet/second/second with an initial ramp between 0.5 and 0.75 second/second.
 3. Provide smooth and constant acceleration and deceleration of not more than 2.8 feet/second/second with an initial ramp between 0.5 and 0.75 second.
 4. Provide no more than 12 ft/sec of maximum jerk.
- G. Running Test:
 1. Load elevator to its rated capacity and operate continuously for one (1) hour over its full travel distance, stopping at each landing, providing a complete door open and close cycle.
 2. Record speed up and down and leveling relative to landing sills at the end of the period.
- H. Protection:
 1. At time of final completion of elevator work (or portion thereof), provide suitable protective coverings, barriers, devices, signs or such other methods or procedures to protect elevator work from damage or deterioration.
 2. Maintain protective measures throughout remainder of modernization period.
 3. Elevator Contractor is responsible for damage and wear during the modernization period, and shall repair or replace, to the Owner's satisfaction, any components worn significantly or damaged before the Owner obtains beneficial use.

3.04 INSTRUCTION AND MAINTENANCE

- A. Instruct Owner's personnel in proper use and operations of elevator. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation.

3.05 CONDITIONS PRECEDENT TO FINAL ACCEPTANCE

- A. Instructions to Operators:
 1. The Elevator Contractor shall have completed instruction of the designated employees of the Owner in the operation and care of equipment and systems.

- B. Code Compliance:
 - 1. All Code compliance tests shall have been performed and acceptance certified by the authorities having jurisdiction and permanent elevator operating permit issued to the Owner.
- C. Acceptance Tests:
 - 1. All acceptance tests shall have been completed and compliance certified by the Owner and Elevator Consultant.
- D. Submittal of Maintenance Manuals:
 - 1. All manuals shall have been submitted and approved by the Owner and Elevator Consultant.
- E. Submittal of Construction Record Drawings:
 - 1. Drawings of the work shall have been marked to show changes and actual modernization conditions, sufficient to form a complete record for Owner's purposes. Give particular attention to work which will be concealed and difficult to measure and record at a later date, particularly items which may require servicing or replacement during the life of the projects.
- F. Final Check:
 - 1. Make a final check of elevator operation, with Owner's personnel and Elevator Consultant present and just prior to date of substantial completion to determine that control systems and operating devices are functioning properly. Any and all damage and/or significant wear shall have been repaired.
- G. Cleaning:
 - 1. The work site shall be clean at all times. The Elevator Contractors shall clear away all debris, surplus materials, etc., resulting from their work or operations, leaving the job and equipment furnished in a clean, first-class condition on a daily basis.
- H. Punchlist:
 - 1. All items on the Punchlist prepared by Elevator Consultant shall be completed within two (2) weeks of issuance to the satisfaction of the Owner and Elevator Consultant. Elevator Contractor to submit to Elevator Consultant and Owner a copy of the State of Oregon Elevator Inspectors Field Report including all Punch List items.

END OF SECTION

BASIC FIRE SUPPRESSION MATERIALS AND METHODS

PART 1 GENERAL**1.01 DESCRIPTION**

- A. The intent of the Division 21 specifications and the accompanying drawings is to provide complete and workable systems as shown, specified and required by applicable codes and standards. Include all work specified in Division 21 and shown on the accompanying drawings and required by applicable codes and standards. The following requirements are included in this Section to expand the requirements specified in Division 01.

1.02 REFERENCES

- A. FM: FM Global
- B. NEMA: National Electrical Manufacturers Association
- C. NFPA: National Fire Protection Association
- D. OR-OSHA: Oregon Occupational Safety and Health Administration

1.03 SUBMITTALS

- A. Follow the procedures outlined below and as specified in Division 01.
- B. Submit for approval, submittal documents as required in each Specification Section.
 - 1. Submit all shop drawings and product data grouped to include submittals of related systems, products, and accessories in a single electronic submittal in PDF format.
 - 2. Each submittal shall be indexed according to Specification Section.
 - 3. Each Specification Section shall be a separate file.
 - 4. Create PDFs at native size and right-side up; illegible files and secured files will be rejected.
 - 5. Mark dimensions and values in units to match those specified.
 - 6. Include equipment mark numbers matched to drawing schedules.
 - 7. If hard copies are specifically requested in Division 01, they shall be indexed according to Specification Section and bound in a three-ring binder.
- C. No apparatus or equipment shall be shipped or fabricated until submittal documents for same have been reviewed and accepted.
- D. Submittals not requested will not be recognized or reviewed.
- E. Proposed Products List: In addition to the requirements of individual specification sections, include the following:
 - 1. Manufacturer's name and address
 - 2. Catalog designation or model number.
 - 3. Equipment schedule number (cross referenced from drawings).
 - 4. Rough-in data and dimensions
 - 5. Performance curves and related capacities
 - 6. Airborne noise levels.
 - 7. Detailed point-by-point control drawings, including manufacturers catalog numbers of all devices and description of all components cross referenced to the control drawings. Include sequence of operation.

1.04 QUALITY ASSURANCE

- A. Materials and equipment shall be new. Work shall be of good quality, free of faults and defects.
- B. All equipment shall fit in the space provided.
- C. Systems shall be built and installed to deliver their full rated capacity at the efficiency for which they were designed.
- D. Fire Suppression systems shall operate at full capacity without objectionable noise or vibration.

BASIC FIRE SUPPRESSION MATERIALS AND METHODS

- E. Materials and Equipment:
 - 1. Each piece of equipment provided shall meet all detailed requirements of the drawings and specifications and shall be suitable for the installation shown.
 - 2. Where two or more units of the same class of equipment are provided, use products of the same manufacturer; component parts of the entire system need not be products of the same manufacturer.
- F. Workmanship:
 - 1. Install all materials in a neat and workmanlike manner.
 - 2. Follow manufacturer's directions. If they are in conflict with the contract documents, obtain clarification before starting work.
- G. Cutting and Patching:
 - 1. Cutting, patching and repairing shall be in accordance with the requirements in Division 01. In addition to the requirements specified in Division 01, include the following: plastering, masonry work, concrete work, carpentry work, firestopping, and painting, shall be performed by skilled craftsmen of each respective trade in conformance with the appropriate division of work. Additional openings required in building construction shall be made by drilling or cutting.
 - 2. Fill holes which are cut oversize so that a tight fit is obtained around the objects passing through.
 - 3. Do not pierce beams or columns without permission of the architect and then only as directed.
 - 4. New or existing work that is cut or damaged shall be restored to its original condition. Where alterations disturb existing finishes, the surfaces shall be repaired, refinished and left in condition existing prior to commencement of work.

1.05 SPECIFICATIONS COMPLIANCE

- A. The requirements of these specifications shall be complied with in every respect. Therefore, it shall be mandatory that the job foreman, all lead mechanics, subcontractors and their foreman have completely studied these specifications, be completely knowledgeable as to their entire contents, and maintain a copy at the job-site. Failure to comply with this requirement will be reason to presume the foreman, lead mechanic or subcontractor is not in responsible charge of their work due to ignorance of job requirements and will be reason for the owner to require dismissal and replacement with approved personnel. Every foreman and lead mechanic shall be provided with a complete copy of this specification.
- B. Enlarged scale plans, sections, and details shall take precedence over small scale plans.

1.06 STANDARD SPECIFICATIONS

- A. The chemical and physical properties of all materials and the design performance characteristics and methods of construction of all items of equipment shall be in accordance with the requirements of the latest issue of the various applicable Standard Specifications at the time of bid.

1.07 CONTRACT DOCUMENTS

- A. Contract Documents for Work are in part diagrammatic, intended to convey the scope of work and indicate general arrangement of equipment, piping and approximate sizes and locations of equipment and outlets. They do not show every offset, bend, tee, or elbow which may be required to install work in the space provided and avoid conflicts. Do not scale the Contract Documents for measurements.
- B. Outlets or equipment shown on the Drawings with no indication shall be completed in the same method and manner as similar outlets or equipment shown on the Drawings.

BASIC FIRE SUPPRESSION MATERIALS AND METHODS

- C. The Contractor shall follow the Contract Documents in laying out the work, to become familiar with all conditions affecting the work and shall verify all spaces in which the work will be installed.
- D. Where job conditions require reasonable changes in indicated locations or arrangements, make changes without additional cost to the Owner.
- E. The Contract Documents and Specifications are to be cooperative and whatever is called for by either shall be binding as if called for by both.

1.08 USE OF EQUIPMENT

- A. The use of any equipment or any part thereof, for purposes other than startup and testing shall be prohibited.

1.09 PLACEMENT OF ORDERS

- A. No consideration will be given to requests for substitutions because of delivery problems or failure to order equipment in a timely manner.

1.10 RECORD DOCUMENTS

- A. Prepare record documents in accordance with the requirements in Division 01. In addition to the requirements specified in Division 01, indicate the following installed conditions:
- B. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., strainers, expansion compensators, tanks, etc.). Valve locations diagrams, complete with valve tag chart.
- C. Equipment locations (exposed and concealed), dimensioned from prominent structural building lines.
- D. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

1.11 OPERATION AND MAINTENANCE MANUALS (O&M)

- A. Prepare operation and maintenance manuals in accordance with Division 01. In addition to the requirements specified in Division 01, include the following information for equipment items:
 - 1. O&M Manuals, including shop drawings, shall be indexed according to Specification Section.
 - 2. Each Specification Section and Drawing Discipline shall be a separate file.
 - 3. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
 - 4. Manufacturer's printed operating procedures to include start-up, break-in, and routine, normal and emergency operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
 - 5. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and re-assembly; aligning and adjusting instructions.
 - 6. Servicing instructions, lubrication charts, schedules, and testing as required by NFPA.
- B. Maintenance manuals shall be submitted and approved prior to any system functional testing.
- C. Manuals shall be project specific.

PART 2 PRODUCTS**2.01 ACCESS PANELS**

- A. Comply with the requirements of Division 08.
- B. Access panels shall be minimum 18 inches by 18 inches in ceilings soffits and shafts, and minimum 12 inches by 12 inches in walls, unless indicated otherwise.

BASIC FIRE SUPPRESSION MATERIALS AND METHODS

- C. Provide access panels where indicated and where required to access valves, fire dampers, trap primers, shock arresters, and other appurtenances requiring operation, service, or maintenance. Review locations prior to installation.

2.02 PIPE SLEEVES

- A. Interior Wall and Floor Sleeves: 18 gauge galvanized steel.
- B. Exterior Wall Sleeves: Cast iron.
- C. On-Grade Floor Sleeves: Cast iron.

2.03 FLOOR, WALL, AND CEILING PLATES

- A. Provide stamped split-type escutcheon plates for piping as follows:
- B. Floor Plates: Cast brass, chromium plated.
- C. Wall and Ceiling Plates: Spun aluminum.

2.04 SEALANT

- A. Comply with requirements in Division 07. Sealants to be suitable for materials joined and application.

2.05 MACHINERY GUARDS

- A. Provide guards for protection on all rotating and moving parts of equipment.
- B. Provide shaft holes in guards for easy use of tachometers at shaft centers. Guards shall be easily removable.
- C. All guards shall meet OR-OSHA requirements including back plates.

2.06 ELECTRICAL EQUIPMENT

- A. General: All equipment and installed work shall be as specified under Division 26, Electrical.
- B. Motors:
 - 1. Motors shall be furnished as integral part of driven equipment. Motors shall be completely enclosed, fan cooled induction type with sealed ball bearings. Motors 1 hp and above shall be NEMA Premium Efficiency type except for emergency equipment motors, sump pumps, and sewage ejector pump motors. Motors shall be built to NEMA standards for the service intended. The motors shall be rated for the voltage specified, suitable for operation within the range of 10 percent above to 10 percent below the specified voltage.
 - 2. Designed for a synchronous speed of 1800 rpm unless specified otherwise.
 - 3. Motors 1/2 hp and Larger: 3-phase, 60 cycle, 460V, service factor of 1.15, unless specifically noted otherwise.
 - 4. Motors 1/3 hp and Below: 1-phase, 60 cycle ac, 115V unless specifically noted otherwise, complete with integral thermal protection.
 - 5. Provide motors on belt drive equipment of nominal nameplate horsepower with not less than 120 percent of equipment brake horsepower required for performance specified.
 - 6. Have built-in thermal overload protection or be protected externally with separate thermal overload devices with low-voltage release or lockout. Hermetically sealed motors shall have quick trip devices.
 - 7. Life expectancy of bearings shall exceed 100,000 hours of direct couple and 40,000 hours with belt.
 - 8. Motors controlled by variable speed drives shall be inverter duty rated and shall have a Class F insulation or better. Motors shall be able to withstand repeated voltage peaks of 1600 volts with rise times of 0.1 microseconds and greater, in accordance with NEMA Standard MG1, Part 31.
 - 9. Motors served from variable frequency drives shall be equipped with a shaft grounding system utilizing brush grounding kits to provide a path for current to flow between the shaft and the motor frame.

BASIC FIRE SUPPRESSION MATERIALS AND METHODS

10. Frequency drive manufacturers shall provide necessary filters and line reactor type equipment to protect motors from excessive voltage spikes that may exceed insulation requirements of NEMA MG1, Part 31.
 11. For motors 20 hp and greater, submit the following supplemental data:
 - a. Number of stator slots.
 - b. Number of rotor bars.
 - c. Load current.
 - d. Stator resistance.
 - e. Stator configuration delta or wye.
 - f. Bearing manufacturer and part numbers.
 12. Motors shall have a three year warranty.
- C. Starters: See Division 26, Electrical. Starters shall be suitable for performing the control functions required, with the exception of self-contained equipment and where the starters are furnished as part of the control package.
- D. Equipment Wiring: Interconnecting wiring within or on a piece of fire suppression equipment shall be provided with the equipment unless shown otherwise. This does not include the wiring of motors, starters and controllers specified in Division 26, Electrical.
- E. Control Wiring: All control wiring for fire suppression equipment shall comply with their associated NFPA standards.

2.07 SEALING

- A. Seal below grade and between exterior piping and wall sleeves.
- B. Use modular, elastomeric pipe sealing.
 1. Material: EPDM.
 2. Hardware: Stainless steel.
 3. Acceptable Manufactures: Link-seal or approved.

PART 3 EXECUTION**3.01 PROJECT CONDITIONS**

- A. Coordinate exact requirements governed by actual job conditions. Check all information and report any discrepancies before fabricating work. Report changes in time to avoid unnecessary work.

3.02 COOPERATION WITH OTHER TRADES

- A. The Contractor shall cooperate with other trades to avoid interferences in the work and to avoid delays in the construction.
- B. Interference, which occurs as a result of poor coordination or lack of cooperation, shall be corrected at the Contractor's expense.

3.03 DAMAGE TO OTHER WORK

- A. The Contractor shall be held responsible for damage done to existing equipment, structures, pipes, etc., which damage is a direct or indirect result of their work. Such damage will be repaired at the expense of the Contractor.

3.04 REFERENCE TO DESIGN SCHEDULES

- A. The Contractor shall refer to Equipment Schedules for Drawing unit identification number and corresponding area locations, capacity and design requirements.
- B. After the equipment or materials have been installed and tested under operating conditions, if it is found that they do not meet the requirements specified, the Contractor shall remove all such equipment and/or materials that do not meet the specified conditions and replace them with the proper equipment without additional cost to the Owner.

BASIC FIRE SUPPRESSION MATERIALS AND METHODS

3.05 EQUIPMENT INSTALLATIONS AND DESIGN

- A. Certain equipment may need to be installed before enclosures are installed or completed. Doors and other access openings, in some case, may not be large enough to permit passage of the equipment completely assembled.
- B. Investigate and coordinate these conditions prior to fabrication or shipment.
- C. Make provisions for the necessary openings in the building to allow for admittance of all equipment.
- D. Where two or more units of the same class of equipment are required, these units shall be the product of a single manufacturer.
- E. Equipment and accessories not specifically described or identified by manufacturer's catalog numbers shall be designed in conformity with applicable technical standards, suitable for maximum working conditions and shall have a neat and finished appearance.

3.06 EQUIPMENT SCHEDULE

- A. The Equipment specified is intended to indicate the quality and type of equipment to be supplied.
- B. Where the Specifications vary from the schedules, the more stringent shall apply.
- C. All packaged unit equipment and skid mounted plumbing components that are factory assembled shall meet, in detail, the products named and specified.

3.07 EQUIPMENT INSTALLATION

- A. The Contractor shall coordinate the delivery of the equipment with other trades.
- B. The Contractor shall provide the equipment in a suitable knocked down condition for placement in the structure as dictated by available access.
- C. Any costs incurred by the failure of the Contractor to comply with the above shall be at the Contractor's expense.

3.08 ACCESS PANELS

- A. Install in accordance with manufacturer's recommendations, coordinated with architectural features. Review intended locations with the architect prior to installation.

3.09 SLEEVES

- A. General:
 - 1. Lay out work prior to concrete forming. Do all cutting and patching required. Reinforce sleeves to prevent collapse during forming and pouring.
 - 2. Sleeve all core-drilled penetrations, unless detailed otherwise on the drawings.
 - 3. Sleeves shall be large enough to allow 3/4-inch clearance around pipe. When pipe is insulated, insulation shall pass continuously through sleeve with 3/4-inch clearance between insulation and sleeve.
- B. Interior Wall Sleeves:
 - 1. Pack with fiberglass insulation.
 - 2. Terminate sleeve flush with face of wall unless indicated otherwise.
- C. Below-Grade Exterior Wall Sleeves: Sleeves shall be large enough to allow for Link seal and made watertight. Install link seal and size based on pipe and sleeve. Secure sleeves against displacement.
- D. Above-Grade Exterior Wall Sleeves: Similar to interior wall sleeves, except caulk outside with sealant.

BASIC FIRE SUPPRESSION MATERIALS AND METHODS

- E. Sleeves Through Floors:
 - 1. Floor sleeves shall extend 1 1/2 inch above finished floor, except waste stacks using carriers shall have sleeve flush with floor.
 - 2. Do not support pipes by resting pipe clamps on floor sleeves. Provide supplementary members so pipes are floor-supported.
 - 3. Make penetrations watertight by sealing gap between sleeve and the floor with floor penetration sealant as specified in Part 2.
- F. Sleeves Through Fire-Rated Floors: Install the same as sleeves through floors, except:
 - 1. Make penetrations through floor watertight by sealing gap between sleeve and floor with floor penetration sealant as specified in Part 2, and
 - 2. Provide firestopping system both inside and outside of sleeve as specified in Division 07, and in accordance with the recommendations of FM Global.
- G. Sleeves Through Fire-Rated Walls: Provide firestopping system as specified in Division 07, and in accordance with the recommendations of FM Global.
- H. On-Grade Floor Sleeves: Same as for below-grade exterior wall sleeves, except caulked from inside.
- I. Sleeves Through Roof: Extend 8 inches above roof.
- J. Sleeves specified or indicated at fire/smoke damper penetrations shall take precedence over this article.

3.10 FIRESTOPPING

- A. Comply with the requirements of Division 07.
- B. Provide fire-rated assemblies at all penetrations of 1 hour or more.

3.11 CLEANING

- A. Clean equipment, fixtures and piping of stampings and markings (except those required by codes), iron cuttings, and other refuse.
- B. Clean scratched or marred painted surfaces of rust or other foreign matter and paint with matching color industrial enamel, except as otherwise noted.

3.12 EQUIPMENT PROTECTION

- A. Keep pipe and conduit openings closed by means of plugs or caps to prevent the entrance of foreign matter. Protect piping, conduit, ductwork, fixtures, equipment, and apparatus against dirty water, chemical, or mechanical damage both before and after installation. Restore damaged or contaminated piping, fixtures, equipment, or apparatus to original conditions or replace at no additional cost to the Owner.
- B. Protect bright finished shafts, bearing housings, and similar items until in service. No rust will be permitted.
- C. Cover or otherwise suitably protect equipment and materials stored on the job site.

3.13 ACCESSIBILITY

- A. Conveniently locate control panels, hardware and devices, valves, thermometers, gauges, cleanout fittings, and other equipment or specialties requiring frequent reading, adjustments, inspection, repairs, or removal and replacement.
- B. Install thermometers and gauges to be easily read from floors, platforms, and walkways.
- C. Provide 36 inches clear access space on each side of variable and constant volume terminal units containing control valves, actuators, electrical disconnect, and DDC controls. Coordinate with other trades the locating of light fixtures, fire sprinkler piping, as well as other equipment, piping, and conduit to avoid obstructing access to serviceable components of terminal units.

BASIC FIRE SUPPRESSION MATERIALS AND METHODS

- D. Provide access panels in linear metal, wood slat, gypsum board, or other hard ceilings and walls to permit convenient access isolation, emergency shut-off, and other valves.

3.14 FLOOR, WALL AND CEILING PLATES

- A. Install plates on piping passing through finished walls, floors, ceilings, partitions and plaster furrings. Plates shall completely cover opening around pipe.
- B. Secure wall and ceiling plates to pipe, insulation, or structure.
- C. Plates shall not penetrate insulation vapor barriers.
- D. Plates are not required in mechanical rooms or unfinished spaces.

3.15 ELECTRICAL EQUIPMENT

- A. No piping, ducts, leak protection apparatus, or other equipment foreign to the electrical installation shall be located in the dedicated electrical space around electrical equipment.
- B. The area above the dedicated electrical space shall be permitted to contain foreign systems, provided protection is installed to avoid damage to the electrical equipment from condensation, leaks, or breaks in such foreign systems.
- C. Unions in fire suppression piping shall not be installed in dedicated electrical or IT spaces, or above or below ceilings.
- D. Low point drains in fire suppression piping shall not be installed in dedicated electrical or IT spaces, or above or below ceilings. If this cannot be avoided, the low point drain connection shall be extended outside of the electrical or IT space.
- E. Protect outdoor electrical equipment from accidental spillage or leakage from piping systems.

3.16 EQUIPMENT CONNECTIONS

- A. Make final connections to equipment in accordance with manufacturer's instructions, shop drawings, and as indicated.
- B. Piping:
 - 1. Connections shall include hot and cold water, fuel and gas, compressed air, sanitary waste and vent, roof and overflow roof drains, and liquid grease.
 - 2. Provide easily accessible unions and gate valves in all piping at equipment, waste traps, and any other fittings required for complete installation.
 - 3. Piping connections shall be independently supported to prevent undue strain on equipment.

3.17 PAINTING

- A. Comply with the requirements of Division 09.
- B. Equipment Rooms and Finished Areas:
 - 1. Insulation: Not painted.
 - 2. Hangers, Uninsulated Piping, Miscellaneous Iron Work, Structural Steel Stands, Uninsulated Tanks, Equipment Bases: Paint one coat of black enamel.
 - 3. Steel Valve Bodies and Bonnets: Paint one coat of black enamel.
 - 4. Brass Valve Bodies: Not painted.
 - 5. Equipment Without Factory Finish: Paint one coat of grey machinery enamel. Do not paint nameplates.
- C. Concealed Spaces (above ceilings, not visible):
 - 1. Insulation: Not painted.
 - 2. Hangers, Uninsulated Piping, Miscellaneous Iron Work, Valve Bodies and Bonnets: Not painted.
- D. Exterior Black Steel: Wire brush and apply two coats of rust-inhibiting primer and one coat of grey exterior machinery enamel.

BASIC FIRE SUPPRESSION MATERIALS AND METHODS

3.18 POWDER-ACTUATED FASTENERS

- A. Powder-actuated fasteners are not allowed.

3.19 ADJUSTING AND CLEANING

- A. Before operating equipment or systems, make thorough check to determine that systems have been flushed and cleaned as required and equipment has been properly installed, lubricated, and serviced. Check factory instructions to see that installations have been made properly and that recommended lubricants have been used.
- B. Use particular care in lubricating bearings to avoid blowing out seals from over-lubrication. Check equipment for damage that may have occurred during shipment, after delivery, or during installation. Repair damaged equipment or replace with new equipment when approved by the Owner's Representative.

3.20 OPERATING INSTRUCTIONS

- A. Instruct the Owner's personnel in the care, operation and maintenance of all apparatus and equipment. Instructions shall be given verbally at the job site by a qualified, experienced representative of the Contractor.
- B. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use. Digital format to comply with Owner's requirements.

END OF SECTION

FIRE SUPPRESSION SYSTEMS

PART 1 GENERAL**1.01 DESCRIPTION**

- A. This section describes a complete automatic fire sprinkler system with zoning and layout, and standpipe outlets off zone sprinkler piping.
- B. Building to be fully sprinklered per NFPA 13.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 210050, Basic Fire Suppression Materials and Methods.

1.03 REFERENCES

- A. ANSI: American National Standards Institute
- B. ASCE: American Society of Civil Engineers
- C. ASTM: American Society for Testing and Materials
- D. AWWA: American Water Works Association
- E. FM: FM Global
- F. NFPA: National Fire Protection Association
- G. MSS: Manufacturers Standardization Society

1.04 SUBMITTALS

- A. Delegated-Design: Shop drawings, hydraulic calculations, and seismic calculations shall be stamped and signed by a fire suppression engineer registered in the State of Oregon.
 - 1. Prepare fire protection system layout drawings showing the types, location, and layout of sprinkler heads and outlets, alarm valves, and devices, pipe sizes and cutting lengths, test tees and valves, seismic braces, and other related items, coordinated with architectural, structural, mechanical, and electrical details. Indicate types and locations of couplings and seismic support locations and details. Sprinkler floor plans shall be scaled at 1/8" = 1'-0" or larger. Sections of congested areas shall be scaled at 1/4" = 1'-0" or larger.
 - 2. Show complete sway brace layout, including proposed brace type and size, anchor methods and sizes, angle of attachment, etc. The design shall demonstrate that an adequate load path is available from the sprinkler pipe to the primary building structure. Note flexible vs. rigid coupling locations as well as clearances where pipes pass through floors and walls.
 - 3. Prepare hydraulic calculations in accordance with the quality assurance requirements of this section.
 - 4. Submit fire protection system layout drawings to the Architect for preliminary review prior to submitting documentation to the fire marshal for final review and approval. Include hydraulic calculations, seismic bracing calculations, and product data.
 - 5. Upon receipt of comments from the Architect, revise and re-submit fire protection system layout drawings, product data, hydraulic calculations, and seismic calculations for final review and approval by the fire marshal.
- B. Product data for the following:
 - 1. Piping and fittings
 - 2. Hangers and Supports
 - 3. Sprinkler heads.
 - 4. Valve Tags, Piping Markers, Equipment Nameplates
 - 5. Valve tag directory and Equipment nameplate directory
- C. Provide Fire-Hydrant flow test report.

FIRE SUPPRESSION SYSTEMS

- D. Operation and maintenance data, and operation and maintenance manuals. Including the following:
 - 1. Legible copy of approved shop drawings, neatly marked with as-constructed changes.
 - 2. Valve Tag and Equipment Nameplate directories.
 - 3. A shutdown plan for the existing fire sprinkler system based on phasing of work. Minimize system shutdown time where existing systems will be capped, removed, or modified.
- E. Test Reports and Certificates: Certificates of inspections and pipe tests.

1.05 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Fire protection system components shall be new and FM-approved with an installation meeting the current FM and NFPA 13 standards covering sprinkler system installation.
 - 2. Design and install earthquake protection of sprinkler systems in accordance with ASCE 7, NFPA 13, and FM's Earthquake Protection of Water Based Fire Protection Systems standards. Design details and seismic load calculations are required. Base calculations on water-filled weight of sprinkler piping within the zone of influence times a horizontal acceleration "G" factor of 0.5.
 - 3. Storage areas shall include a 500 gpm hose allowance, while other areas should reserve 250 gpm hose allowance. All designs shall include a 10 percent cushion in the water supply.
- B. Hydraulically Calculated Sprinkler System shall be in accordance with the following NFPA 13 requirements.
- C. Pipe schedule sprinkler system sizing is prohibited.
- D. Pipe Cleaning: Should any pipe be plugged or should foaming of water systems occur, disconnect piping, re-clean, and reconnect with no additional cost to the Owner.
- E. Correct any damage to the building or systems resulting from failure to properly clean the system with no additional cost to the owner.

PART 2 PRODUCTS**2.01 LIGHT WALL BLACK STEEL PIPE**

- A. Pipe: ASTM A135 or A53. Schedule 10 for sizes 2 1/2-inches to 5-inches.
- B. Fittings: Roll grooved ends with mechanical couplings.
- C. Service: Fire protection system only for sizes listed, as approved by NFPA 13. All dry pipe sprinkler systems shall be hot dip galvanized.

2.02 STEEL PIPE, SCHEDULE 40

- A. Pipe: Schedule 40, in accordance with ASTM A53 or A795. Provide roll-grooved ends for piping joined by mechanical couplings.
- B. Fittings: UL-Listed and FM Approved Class 150 malleable iron threaded fittings on 2 inches and below. Schedule 40 welded fittings in accordance with ASTM A234 for 2 1/2 inches and above or mechanical couplings. Fittings below grade shall be welding fittings. All elbows on pumped systems shall be long radius type. Short radius elbows are not acceptable for use, unless indicated otherwise on the drawings.
- C. Service: Wet pipe sprinkler systems to be either black or hot dip galvanized.

FIRE SUPPRESSION SYSTEMS

2.03 FLANGED JOINTS

- A. Flanges shall be cast iron or steel for threaded piping and forged steel weld neck flanges for welded line sizes. Pressure rating and drilling shall match the apparatus, valve or fitting to which they are attached. Flanges shall be in accordance with ANSI B16.5; Class 150 for system pressures to 150 psig, unless noted otherwise for high temperature applications; Class 300 for system pressures 150 psig to 400 psig. Gaskets shall be 1/16-inch thick, non-asbestos ring type, coated with graphite and oil to facilitate making a tight joint. Make joint using American Standard hexagon head bolts, lock washers and nuts in accordance with ASTM A307 Grade B for service pressures to 150 psig; alloy steel stud bolts, lock washer and American Standard hexagon head nuts in accordance with ASTM A307 Grade B for service pressures 150 psig to 400 psig. Use length of bolt required for full nut engagement. Provide high-strength stainless steel bolting in compliance with ASME NC-3658.3 where indicated on plans.

2.04 UNIONS

- A. Unions shall be 150 psi malleable iron or brass, brass to iron seat or viton O-ring, ground joint, black or galvanized to match pipe. 200 psi WOG bronze, ground joint, solder type for copper tubing. Where dissimilar metals join, dielectric unions, couplings or flanges shall be installed.

2.05 MECHANICAL PIPE COUPLINGS AND FITTINGS

- A. Acceptable Manufacturers: Victaulic, Anvil, or Approved.
- B. Flexible Couplings and Fittings:
 - 1. Coupling housing shall be ductile iron conforming to ASTM A536, Grade 65-45-12 with factory standard enamel/paint finish. Coupling gasket shall be Grade "E" EPDM. Coupling bolts shall be oval neck track head type in compliance with ASTM A449 or SAE J429, Grade 5. Coupling nuts shall be hexagonal heavy nuts per ASTM A563, Grade B. Use flexible couplings only when expansion contraction, deflection, or noise and vibration is to be dampened.
 - a. Rigid coupling housing basis of design is Victaulic Type 07.
 - b. Flexible coupling housing basis of design is Victaulic Type 77.
 - 2. Fittings used with pipe couplings shall be fabricated of malleable iron castings in accordance with ASTM A47. Where malleable fitting pattern is not available, fittings fabricated from Schedule 40 steel pipe or standard wall seamless welding fittings with grooved ends may be used. Elbows on pumped systems shall be long radius type.
- C. Flexible Sprinkler Drops: Braided flexible hose assembly that UL listed and FM approved. Assembly shall comply with UL 2443 and 1474.
- D. Service: Fire protection systems.

2.06 MECHANICAL JOINT RESTRAINTS

- A. Acceptable Manufacturers: EBAA Iron Inc., Megalug Series 1100, Sigma One-Lok, or Approved.
- B. Incorporate mechanical restraint into the joint follower gland, consisting of individually actuated wedges that increase their resistance to pullout as pressure increases. Use twist-off nuts, 350 psi working pressure. UL-listed and FM Approved Mechanical joint type complete with gaskets, bolts, and nuts in compliance with ANSI/AWWA C111/A21.11 and ANSI/AWWA C153/A21.53. Restraints shall be UL listed and FM Global approved.
- C. Service:
 - 1. Dry standpipe, below grade.

2.07 HANGERS AND SUPPORTS

- A. Support materials to comply with NFPA 13 along with being UL listed and FM approved. Acceptable manufacturers include but not limited to the following: Anvil, nVent, PHD Manufacturing, and Tolco.

FIRE SUPPRESSION SYSTEMS

2.08 SPRINKLER HEADS

- A. As indicated; equivalent products by Reliable, Tyco, Victaulic, Viking or Approved.
- B. All heads shall be UL listed for application and installation and FM approved. Provide high temperature heads for mechanical rooms, areas below skylights, and other areas which have high heat producing equipment to prevent accidental tripping.
- C. Sprinkler Heads:
 - 1. Sprinklers installed in finished ceilings shall be concealed ceiling type, chrome finish.
 - 2. Sprinklers installed at areas with unfinished ceilings shall be upright or pendant type, rough bronze finish.
 - 3. In finished areas, extended coverage horizontal sidewall, fast response, chrome plated.
 - 4. In outside air and exhaust plenums, sprinkler heads shall be rough brass finish, horizontal dry sidewall sprinkler.
 - 5. In computer room (pre-action system), chrome plated, dry pendant sprinkler.
 - 6. Head Guards: In locations susceptible to physical damage, provide guards manufactured by sprinkler head manufacturer, with welded wire to withstand heavy impact.

2.09 SPECIALTY VALVES

- A. Acceptable Manufacturers: Nibco, Apollo, or Approved.
- B. Drain Valves: Bronze ball valve, garden hose end, cap and chain 3/4-inch size, bronze cast body, chrome-plated full port ball, threaded, with handle, Teflon seat, threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing, 600 psi CWP.
- C. Gauge Cocks: Brass, tee handle, male to female, 200 psi working pressure, 1/4-inch.

2.10 VALVE IDENTIFICATION

- A. Valve Tags:
 - 1. General: Identify valves with metal tags. Legends shall be stamped or embossed. Tags shall indicate the function of the valve and its normal operating position.
 - 2. Size: Valve tags 2-inch diameter with 1/4-inch-high letters.
 - 3. Material: Use 0.050 or 0.064-inch brass tags.
 - 4. Automatic Valves and Regulating Valves: Use 1/16-inch-thick laminated 3-ply plastic, center ply white, outer ply black. Form letters by exposing center ply.
 - 5. Existing Buildings and Systems: Contact the Owner's Representative for coordination with existing building tagging system and supplementary information required for any specific system before valve tagging begins.
- B. Valve Tag Directory: Include tag number, location, exposed or concealed, service, valve size, valve manufacturer, valve model number, tag material, and normal operating position of valve.

2.11 PIPING MARKERS

- A. Acceptable Manufacturers: W. H. Brady, Seton, Marking Systems, Inc. (MSI), or Approved.
- B. Label pipes with all-vinyl, self-sticking labels or letters. For pipe covering sizes up to and including 3/4-inch outside diameter, select labels with 1/2-inch letters. For sizes from 3/4- to 2-inch outside diameter, 3/4-inch letters; above 2 inches outside diameter, 2-inch letters. The pipe markers shall be identified and color coded in compliance with ANSI 13.1-2015 Standard. Exposed sprinkler piping in public areas is exempt from labeling.

2.12 EQUIPMENT IDENTIFICATION

- A. Nameplates:
 - 1. Tag all pumps, and miscellaneous items of fire suppression equipment with engraved nameplates. Nameplates shall be 1/16-inch-thick, 3 x 5 laminated 3-ply plastic, center ply white, outer ply black. Form letters by exposing center ply.
- B. Identify unit with code number as shown on drawings and area served.

FIRE SUPPRESSION SYSTEMS

- C. Equipment Nameplate Directory: List pumps, and other equipment nameplates. Include Owner- and Contractor-furnished equipment. List nameplate designation, manufacturer's model number, location of equipment, area served or function, disconnect location, and normal position of HOA switch.

2.13 MISCELLANEOUS ACCESSORIES

- A. Provide UL labeled and FM approved check valve with rubber lined seats.
- B. Provide ball drip drains, test orifices, and other related items as required to provide a complete fire protection system.
- C. Items shall be UL labeled and FM approved for application as required.

PART 3 EXECUTION**3.01 COORDINATION**

- A. Notify the Owner's representative 72 hours in advance of any shutdown of existing sprinkler system. Coordinate fire watch requirements with Owner's representative prior to notification of existing sprinkler system shutdown.
- B. Coordinate fire protection piping and appurtenances with ducts, other piping, electrical conduit, moving walkways, and other equipment.
- C. Conceal fire protection piping and equipment except in areas without ceilings and as noted on the drawings.
- D. Locate valves, piping, heads, and equipment where shown on the drawings. System drain valves are not shown. Install as required to permit drainage of all systems.

3.02 PREPARATION

- A. Measurements, Lines, and Levels:
 - 1. Check dimensions at the building site and establish lines and levels for the work specified in this section.
 - 2. Establish all slopes and elevations by instrument, working from an established datum point. Provide elevation markers for use in determining slopes and elevations in accordance with the drawings and specifications.
 - 3. Use established grid and area lines for locating trenches in relation to buildings and boundaries.

3.03 PIPING INSTALLATION

- A. Install unions in all non-flanged piping connections to apparatus and adjacent to all screwed valves and appurtenances requiring removal for servicing, located so that piping may be disconnected without disturbing the general system.
- B. Mechanical Couplings:
 - 1. On systems using galvanized pipe and fittings, fittings shall be galvanized at factory.
 - 2. Before assembly of couplings, lightly coat pipe ends and outside of gaskets with manufacturer's approved lubricant.
 - 3. Pipe grooving shall be in accordance with manufacturer's specifications contained in latest published literature.
- C. Install all piping to drain.
- D. Support all piping independently so that its weight is not carried by the equipment. Support piping per NFPA 13 and seismic requirements.

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3.04 PIPING JOINTS

- A. Join pipe and fittings using methods and materials recommended by the manufacturer, in accordance with standard practice and applicable codes. Cleaning, cutting, reaming, grooving, etc., shall be done with proper tools and equipment. Hacksaw pipe cutting is prohibited. Peening of welds to stop leaks is not permitted.
- B. Do not install couplings in floor, wall, grade beam sleeves, or other locations that are inaccessible for coupling removal and/or replacement.
- C. Steel Piping:
 - 1. Screwed Joints: Cut pipes evenly with pipe cutter, and ream to full inside diameter, with all burrs and cuttings removed. Joints shall be made up with suitable lubricant or Teflon tape, applied to male threads only, leaving two threads bare. Tighten joints so not more than two threads are left showing.
 - 2. Flanged Joints: Pressure rating of flanges shall match valve or fitting joined. Coat joint gaskets with graphite and oil.
- D. Welded Joints:
 - 1. Preparation for Welding: Bevel piping on both ends before welding.
 - a. Use following weld spacing on all butt welds:

<u>Nominal Pipe Wall Thickness</u>	<u>Spacing</u>	<u>Bevel</u>
1/4" or less	1/8"	37 1/2°
Over 1/4", less than 3/4"	3/16"	27 1/2°
 - b. Before welding, remove all corrosion products and foreign material from surfaces.
 - 2. Joints shall be made by the arc-welding process using ASME certified welders. Port openings of fittings shall match the inside diameter of the pipe to which they are welded. Use full radius welding elbows for all turns; use welding tees for all tees. Use reducing fittings for size reduction. Weldolets or threadolets may be used for branches up through one-half the pipe size of the main to which they are attached. Nipples will not be allowed.
 - 3. Welding Operation:
 - a. After deposition, clean each layer of weld metal to remove slag and scale by wire brushing or grinding. Chip where necessary to prepare for proper deposition of next layer.
 - b. Weld reinforcement no less than 1/16 inch nor more than 1/8 inch above normal surface of jointed sections. Reinforcement shall be crowned at center and tapered on each side to surfaces being joined. Exposed surface of weld shall be free of depressions below surface of jointed members.
 - c. No welding shall be done when temperature of base metal is lower than 0°F. Material to be welded during freezing temperatures shall be made warm and dry before welding is started. Metal shall be warm to the hand or approximately 60°F.
- E. Screwed Joints: Use Teflon tape or Teflon liquid dope applied to male threads only.

3.05 INSTALLATION

- A. Piping:
 - 1. Hold piping as tight to structure as possible. In general, run piping in areas without ceilings parallel to building elements.
 - 2. Provide test tees as required.
- B. Drain Piping:
 - 1. Pitch drain piping 1/2-inch per 10 feet minimum; no traps will be allowed.

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2. Pipe inspector test connections to exterior at grade level only and discharge onto suitable splash plate as approved by local applicable governing authorities. Inspector test discharge for mezzanine level or roof/penthouse sprinkler zones shall not discharge onto roofs. Provide chrome plated wall flanges on exterior building wall penetrations.
3. Drain valves shall be no higher than 5'-0" above floor level.
4. Pipe drain valves for pre-action systems located within the interior of the building through air gap to the sanitary sewer.
5. For drains piped to the outside, provide an additional full-sized tee inside the building to discharge to the nearest floor drain.

C. Electrical: All electrical work shall comply with Division 26.

3.06 VALVE INSTALLATION

- A. Provide valves at connections to equipment where shown or required for equipment isolation.
- B. Install all valves accessible and same size as connected piping.
- C. Provide separate support for valves where necessary.
- D. Grooved type valve end connections may be used in lieu of flanged on services where mechanical pipe couplings and fittings are specified.
- E. Provide drain valves in all low points in the piping system, at coils and equipment and as indicated.
- F. Identify valves to indicate their function and system served.

3.07 VALVE IDENTIFICATION

- A. Valve Tags:
 1. Attach to valve with a brass chain.
 2. Number valves per direction of the Owner's Representative.
- B. Valve Tag Directory: Post final copy in operation and maintenance manual and on associated fire risers.

3.08 PIPING MARKERS

- A. Unless recommendations of ANSI A13.1 are more stringent, apply labels or letters after completion of pipe cleaning, insulation, painting, or other similar work, as follows:
 1. Every 20 feet along continuous exposed lines.
 2. Every 10 feet along continuous lines in mechanical rooms and other areas of congested piping and equipment.
 3. Adjacent to each valve and stubout for future.
 4. Where pipe passes through a wall, into and out of concealed spaces.
 5. On each riser.
 6. On each leg of a "T."
 7. At access doors, manholes and similar access points that permit view of concealed piping.
 8. Locate conspicuously where visible.
- B. Further, apply labels or letters to lower quarters of the pipe on horizontal runs where view is not obstructed or on the upper quarters when pipe is normally viewed from above. Apply arrow labels indicating direction of flow.
- C. Spray a protective coating of clear epoxy over markers and arrows in corrosive atmosphere areas.

3.09 EXTRA STOCK

- A. Provide additional number of heads of each type and temperature rating installed as required to meet NFPA 13 requirements.

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- B. Inside the cabinet, provide a list of heads stored within and a brief description of where installed.
- C. Provide index label for each head indicating manufacturer, model, orifice size or K-factor, and temperature rating.
- D. Provide two sets of tools for removal of flow switch covers.
- E. Locate cabinet near sprinkler control station as approved.

3.10 ADJUSTING AND CLEANING

- A. Clean interior of all piping before installation.
- B. Flush sediment out of all piping systems with a minimum velocity of 5 to 6 FPS.
- C. Prepare system for adjusting and balancing. If any system components, including control valves, balancing valves, automatic flow control valves, strainers, or other valves and specialties have sediment present, remove, clean and replace damaged or worn components.

3.11 TESTING

- A. Check out, start up, and test items specified in this section.
- B. Notify the Owner 48 hours prior to any test. Provide final test and certification in the presence of the Owner's Representative and Authority Having Jurisdiction.
- C. Pressure System Testing for system: 200-PSIG hydrostatic test pressure for a minimum 2-hours with no loss of pressure or leaks. Repair or replace defective piping and appurtenances.

END OF SECTION

VALVES

PART 1 GENERAL**1.01 DESCRIPTION**

- A. This section describes valves, balancing valves, specialty valves, safety shutoff valves, and water relief valves.

1.02 REFERENCES

- A. ANSI: American National Standards Institute
- B. ASME: American Society of Mechanical Engineers
- C. MSS: Manufacturers Standardization Society

1.03 SUBMITTALS

- A. Submit Product Data, Shop Drawings, And Maintenance Data for Products Specified.

PART 2 PRODUCTS**2.01 GENERAL**

- A. Each type of valves shall be of one manufacturer.
- B. All globe, ball valves shall meet MSS standards.
- C. All domestic water service valves shall comply with NSF 61 Annex G and NSF 372.
- D. Bronze globe and ball valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- E. Valves at insulated piping: Valves shall have 2-inch steam extensions and the following features:
 - 1. Ball Valves: Shall have extended operating handle of non-thermal-conductive materials, protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation, and memory stops that are fully adjustable after insulation is applied.

2.02 GLOBE VALVES

- A. Acceptable Manufacturers: Apollo Valves, Hammond Valve, Milwaukee Valve, Nibco, Watts or Approved.
- B. Bronze Globe and Angle Globe: Bronze body, bronze-mounted, screwed, bronze union bonnet, copper-silicone bronze rising stem, TFE disc, malleable iron hardware, class 125, threaded or soldered ends.

2.03 BALL VALVES

- A. Acceptable Manufacturers: Apollo Valves, Hammond Valve, Milwaukee Valve, Nibco, Watts or Approved.
- B. Bronze Ball: Two-piece bronze body, full port, vented stainless steel ball with handle, teflon seat, threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing, stainless steel stem, 600 psi CWP, 150 psi SWP. Provide valves with threaded or soldered ends.

2.04 SPECIALTY VALVES

- A. Drain Valves and Manual Air Vents: Bronze ball valve, garden hose end, cap and chain 3/4-inch size, bronze body, stainless steel full port ball, threaded, with handle, Teflon seat, threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing, 600 psi CWP.
- B. Gauge Cocks: Brass, tee handle, male to female, 200 psi working pressure, 1/4-inch.

VALVES

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide valves at connections to equipment where shown or required for equipment isolation.
- B. Install all valves accessible and same size as connected piping.
- C. Provide separate support for valves where necessary.
- D. Provide drain valves in all low points in the piping system, at coils and equipment and as indicated.

3.02 VALVE APPLICATIONS

- A. In piping 2 inches and smaller, domestic hot and cold water.
 - 1. Bronze globe.
 - 2. Ball valve.
- B. Provide gauge cock for all pressure gauges.

3.03 DRAIN VALVES AND MANUAL AIR VENTS

- A. Install at high points, low points, and as shown on the drawings, for proper venting and draining of plumbing systems.
- B. Insulate valves in cold water systems to prevent condensation.

3.04 VALVE IDENTIFICATION

- A. Identify valves to indicate their function and system served.

END OF SECTION

HANGERS AND SUPPORTS

PART 1 GENERAL

1.01 DESCRIPTION

- A. This section describes the following:
 - 1. Hangers, supports, and anchors for equipment, tanks, and piping systems.
 - 2. Supplementary steel for support or attachment of tanks, equipment, and piping to general construction elements of the project.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 220713, Plumbing Insulation

1.03 REFERENCES

- A. ASTM: American Society for Testing and Materials
- B. CISPI: Cast Iron Soil Pipe Institute
- C. OSSC: Oregon Structural Specialty Code
- D. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association

1.04 SUBMITTALS

- A. Product Data: For all products specified herein.
- B. Shop Drawings:
 - 1. Submit shop drawings of Contractor-fabricated piping support structures, pipe racks, and anchors.
 - 2. Suspended Piping: Indicate point loads and support locations, along with applicable details keyed to layouts.
 - 3. Support Frames, Piping, Tank, and Equipment Supports, and Anchorage: Indicate point loads and support locations, along with engineers' calculations and details keyed to the layouts pertaining to supports, support frames, and anchorages.
 - 4. Supplementary Steel: Show details of fabrication and installation. Indicate materials, thicknesses, gauges, sizes, dimensions, methods of joining and fastening, welds, finishes, details of reinforcement and embedment, attachments, anchorages, miscellaneous metal items incidental to basic fabrication shown, provisions for work of other trades, and other pertinent information. Submit structural calculations for necessary supplementary steel for supports, anchors, and attachment of equipment, and pipes to general construction. Calculations shall be prepared and stamped by a registered professional structural engineer licensed in the state of Oregon.
 - 5. As-Constructed Drawings and Data.

1.05 QUALITY ASSURANCE

- A. Supports and hangers for piping systems subject to expansion and contraction shall be chosen with careful consideration. The hanger support type selection depends on the directions in which the piping system will expand.

PART 2 PRODUCTS

2.01 SUPPORTS AND ANCHORAGE

- A. Provide pipe, and equipment hangers and supports in accordance with the following:
 - 1. When supports and anchorages for tanks, equipment, conduit, and piping are not shown on the drawings, the Contractor shall be responsible for their design.
 - 2. Supports and anchorages shall resist forces due to hydraulic testing and seismic forces as specified in the OSSC for the ground motion accelerations corresponding to the project location. Exterior equipment, and piping shall be designed to resist wind loads.

HANGERS AND SUPPORTS

3. Supports and anchorages shall not introduce stresses in the piping caused by thermal expansion or contraction.
 4. Connections to structural framing shall not introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.
- B. Fire/Smoke Resistance: Seismic- and wind-load-restraint devices that are not constructed of ferrous metals must have a maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested by an NRTL in accordance with ASTM E84 or UL 723, and be so labeled.
- C. Component Supports:
1. Load ratings, features, and applications of all reinforcement components must be based on testing standards of a nationally recognized testing agency.
 2. All component support attachments must comply with force and displacement resistance requirements of ASCE/SEI 7-16 Section 13.6.

2.02 SUPPORTS, GENERAL

- A. Available Manufacturers: B-Line Systems, Anvil, Superstrut, Unistrut, or equivalent.
- B. Fabricate support members from welded standard structural shapes, pipe, and plate. Carry the necessary rollers, hangers, and accessories as required. Piping less than 4-inch pipe size may be supported from or by prefabricated roll-formed channels as specified in this section with necessary accessories to adequately support piping system.
- C. Supports and Accessories: Preformed roll-formed channels and accessories with matching compatible accessories as shown, as specified, and as required.
- D. Dissimilar Metal Protection: Cush-a-Strip, Hydra-Zorb cushions, B-line ISO pipe isolator, or equivalent.
- E. All exterior materials shall be hot-dip galvanized or stainless steel.

2.03 PIPE ATTACHMENTS

- A. Clamps: MSS SP-58, Type 26, two bolt pipe strap clamp.
- B. Insulated Horizontal Piping: MSS SP-58, Type 1, clevis hanger with Insulation Protection Saddle.
- C. Uninsulated Horizontal Piping: MSS SP-58, Type 1, clevis hanger.
- D. Riser Clamps, Steel and Cast Iron Pipe: MSS SP-58, Type 8. Clamp material shall be suitable for piping.

2.04 PIPE RACKS

- A. Available Manufacturers: Superstrut, Uni-Strut, Cooper B-line or equivalent.
- B. Supports and Accessories: Preformed roll-formed channels and accessories with electrochromate or equivalent finish and matching compatible accessories as shown, as specified, and as required.

2.05 PROTECTION SHIELDS

- A. Select protection shields based on actual outside diameter of pipe plus insulation. Use protection shields at hanger assemblies on cold water piping, where hangers are installed around insulation, and on both sides of clamps or U-bolts where installed around insulation. Provide MSS SP-58, Type 40, Insulation protection shield.

2.06 BUILDING ATTACHMENTS

- A. Beam Hangers – Beam Clamps: MSS SP-58, Type 30, adjustable malleable iron beam clamp, or MSS SP-58, Type 28 or 29, adjustable forged steel beam clamp.
- B. Beam Hangers – C-Type Clamps: MSS SP-58, Type 19 or 23. Sized for required rod to

HANGERS AND SUPPORTS

support load being carried.

- C. Beam Hangers – Welded: MSS SP-58, Type 22. Sized for required rod to support load being carried.
- D. Post-installed concrete anchors:
 - 1. Mechanical Anchor Bolts:
 - a. Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength for anchor and as tested according to ASTM E488/E488M.
 - 2. Adhesive Anchor Bolts:
 - a. Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E488/E488M.
 - 3. Provide post-installed concrete anchors that have been prequalified for use in wind-load applications. Post-installed concrete anchors must comply with all requirements of ASCE/SEI 7-16, Ch. 13.
 - a. Prequalify post-installed anchors in concrete in accordance with ACI 355.2 or other approved qualification testing procedures.
 - b. Prequalify post-installed anchors in masonry in accordance with approved qualification procedures.
- E. Provide preset concrete inserts that are seismically prequalified in accordance with ICC-ES AC408 testing. Inserts to comply with MSS SP-58.

PART 3 EXECUTION

3.01 HANGERS AND SUPPORTS

- A. General:
 - 1. Install all support systems as detailed and in accordance with manufacturer's recommendations. Provide pipe racks, pipe stands, trapeze hangers, etc., as required and as detailed on the drawings.
 - 2. Provide adjustable hangers complete with inserts, adjusters, bolts, nuts, swivels, all-thread rods, etc., for all pipes, except where specified otherwise.
 - 3. Size hangers to clear insulation for piping services conveying liquids less than 70°F.
 - 4. Support fire protection piping independently of other piping.
 - 5. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods. Do not use tape for isolation.
 - 6. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
 - 7. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
- B. Vertical Piping:
 - 1. Support with U-clamps fastened to wall to hold piping away from wall unless otherwise approved.
 - 2. Riser clamps shall be directly under fitting or welded to pipe.
 - 3. Risers shall be supported at each floor of penetration.
 - 4. Provide structural steel supports at the base of pipe risers. Size supports to carry all forces exerted by piping system when systems are in operation.

HANGERS AND SUPPORTS

C. Horizontal Piping:

1. On all insulated piping, provide insulation protection shields at all roller locations.
2. Install hangers outside of insulation, provide insulation protection shields at each hanger location.

D. Trapeze Hangers: Multiple pipe runs where indicated shall be supported on channels with rust resistant finish. Provide all necessary supporting steel.

1. Channels: Unistrut with electro-chromate finish, or equivalent.

E. Hanger Spacing: Provide hangers at minimum spacing in accordance with Chapter 41, ASHRAE Guide and as follows:

1. Steel Pipe, Copper Tubing: For straight runs of horizontal piping with no concentrated loads such as valves, flanges, expansion joints, or other components. Sections of piping with concentrated loads will have to be considered carefully and a determination made as to appropriate spacing and rod size for the given situation.

<u>Pipe Size</u>	<u>Max. Span</u>	<u>Max. Span</u>	
	<u>Steel</u>	<u>Copper</u>	<u>Rod Size</u>
1" and smaller	7 feet	5 feet	3/8"
1-1/4" to 2"	8 feet	7 feet	3/8"
2-1/2" to 3"	11 feet	9 feet	1/2"
4" to 5"	12 feet	10 feet	1/2"

2. Maximum Rod Load: Below are maximum loads for hanger rods based on Chapter 41 of ASHRAE Guide and as follows for ASTM A36, with a safety factor of 5.

<u>Nominal Rod Diameter</u>	<u>Load</u>
3/8"	610 pounds
1/2"	1,130 pounds
5/8"	1,810 pounds
3/4"	2,710 pounds
7/8"	3,770 pounds
1"	4,960 pounds

F. Insulation Protection:

1. Where piping is suspended from insulation, provide 16-gauge galvanized steel protection shields, 12 inches long.
2. Where pipe clamps are installed on insulated piping, provide 16-gauge galvanized steel protection shields, 12 inches long on both sides of insulated pipe.
3. Band shields firmly to insulation to prevent slippage.

G. Building Attachments:

1. Where possible, support all piping and equipment from structural members, beams, and joists. If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
2. Provide structural steel angles, channels, or other members to support piping and equipment where structural members do not occur as required for proper support.
3. Arrange supports to prevent eccentric loading of joists and joist girders. Locate supports at joist panel points or provide web reinforcing as required.

HANGERS AND SUPPORTS

4. Piping Restraints:
 - a. Comply with requirements in MSS SP-127.
 - b. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 - c. Brace a change of direction longer than 12 feet.
 - d. Bracing shall not introduce stresses in the piping system caused by thermal expansion or contraction.
5. Mechanical Anchor Bolts:
 - a. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - b. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - c. Wedge-Type Anchor Bolts: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - d. Adhesive-Type Anchor Bolts: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 - e. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - f. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.
- H. Pipe Racks:
 1. General: Provide racks as shown with additional elements to adequately support piping.
 2. Coordination: Where mechanical piping, tubing, etc., and electrical conduit, wiremold, wireways, etc., follow common routings, coordinate routing. Allow sufficient clearance to adequately operate, access, and maintain all devices without dismantling racks.
- I. Support all piping within 2 feet of change of direction on both sides of fitting.

END OF SECTION

PLUMBING IDENTIFICATION

PART 1 GENERAL

1.01 DESCRIPTION

- A. This section describes the identification of valves, piping, and equipment components of the mechanical systems to indicate their function and system served.

1.02 REFERENCES

- A. ANSI: American National Standards Institute
- B. OPSC: Oregon Plumbing Specialty Code

1.03 SUBMITTALS

- A. Product Data: For all products specified herein.
- B. Valve Tag Directory: Submit for approval prior to fabrication of valve tags.
- C. Equipment Nameplate Directory: Submit for approval prior to fabrication of labels.
- D. Include copy of valve tag and equipment nameplate directories in each set of operation and maintenance manuals.

PART 2 PRODUCTS

2.01 VALVE IDENTIFICATION

- A. Valve Tags:
 - 1. General: Identify valves with metal tags. Legends shall be stamped or embossed. Tags shall indicate the function of the valve and its normal operating position.
 - 2. Size: Valve tags 2-inch diameter with 1/4-inch-high letters.
 - 3. Material: Use 0.050 or 0.064-inch brass tags.
 - 4. Existing Buildings and Systems: Contact the Owner's Representative for coordination with existing building tagging system and supplementary information required for any specific system before valve tagging begins.
- B. Valve Tag Directory: Include tag number, location, exposed or concealed, service, valve size, valve manufacturer, valve model number, tag material, and normal operating position of valve.

2.02 PIPING MARKERS

- A. Acceptable Manufacturers: W. H. Brady, Seton, Marking Systems, Inc. (MSI), or Approved.
- B. Label pipes with all-vinyl, self-sticking labels or letters. For pipe covering sizes up to and including 3/4-inch outside diameter, select labels with 1/2-inch letters. For sizes from 3/4- to 2-inch outside diameter, 3/4-inch letters; above 2 inches outside diameter, 2-inch letters. The pipe markers shall be identified and color coded in compliance with ANSI 13.1-2015 Standard.

2.03 EQUIPMENT IDENTIFICATION

- A. Nameplates:
 - 1. Tag all pumps, and miscellaneous items of plumbing equipment with engraved nameplates. Nameplates shall be 1/16-inch-thick, 3 x 5 laminated 3-ply plastic, center ply white, outer ply black. Form letters by exposing center ply.
 - 2. Identify unit with code number as shown on drawings and area served.
- B. Equipment Nameplate Directory: List pumps, and other equipment nameplates. Include Owner- and Contractor-furnished equipment. List nameplate designation, manufacturer's model number, location of equipment, area served or function, disconnect location, and normal position of HOA switch.

PLUMBING IDENTIFICATION

PART 3 EXECUTION

3.01 VALVE IDENTIFICATION

- A. Valve Tags:
 - 1. Attach to valve with a brass chain.
 - 2. Number valves per direction of the Owner's Representative.
- B. Valve Tag Directory: Post final copy in operation and maintenance manual.
- C. Concealed Valves: Affix color coded "dot" to walls or ceilings wherever valves are concealed. Colors shall be as follows:
 - 1. Domestic CW Green
 - 2. Domestic HW Yellow
 - 3. Plumbing Cleanouts Black

3.02 PIPING MARKERS

- A. Unless recommendations of ANSI A13.1 are more stringent, apply labels or letters after completion of pipe cleaning, insulation, painting, or other similar work, as follows:
 - 1. Every 20 feet along continuous exposed lines.
 - 2. Every 10 feet along continuous lines in mechanical rooms and other areas of congested piping and equipment.
 - 3. Adjacent to each valve and stubout for future.
 - 4. Where pipe passes through a wall, into and out of concealed spaces.
 - 5. On each riser.
 - 6. On each leg of a "T."
 - 7. At access doors, manholes and similar access points that permit view of concealed piping.
 - 8. Locate conspicuously where visible.
- B. Further, apply labels or letters to lower quarters of the pipe on horizontal runs where view is not obstructed or on the upper quarters when pipe is normally viewed from above. Apply arrow labels indicating direction of flow.
- C. Spray a protective coating of clear epoxy over markers and arrows in corrosive atmosphere areas.

3.03 EQUIPMENT IDENTIFICATION

- A. Nameplates: Attach to prominent area of equipment, either with sheet metal screws, brass chain, or contact cement as applicable.
- B. Nameplate Directory: Post final copy in operation and maintenance manual.

END OF SECTION

PLUMBING INSULATION

PART 1 GENERAL

1.01 DESCRIPTION

- A. This section describes insulation for piping, and equipment.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 220050, Basic Plumbing Requirements
- B. Section 220529, Hangers and Supports

1.03 REFERENCES

- A. ASHRAE: American Society of Heating, Refrigeration, and Air-Conditioning Engineers
- B. ASTM: American Society for Testing and Materials
- C. NFPA: National Fire Protection Association
- D. UL: Underwriters Laboratories

1.04 SUBMITTALS

- A. Product Data: For each type of insulation, including density, conductivity, thickness, jacket, vapor barrier and flame spread and smoke developed indexes.

1.05 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Flame and Smoke Ratings: Installed composite flame spread not to exceed 25 and smoke developed not to exceed 50 as tested by UL 723 and ASTM E84.
 - 2. Energy Codes: ASHRAE 90.1-2019 shall govern where requirements for thickness exceeds thickness specified.
- B. Protection: Protect against dirt, water, chemical or mechanical damage before, during, and after installation. Repair or replace damaged insulation at no additional cost to the Owner.
- C. Source Quality Control:
 - 1. Service: Use insulation specifically manufactured for service specified.
 - 2. Labeling: Insulation labeled or stamped with brand name and number.
 - 3. Insulation and accessories shall not provide any nutritional or bodily use to fungi, bacteria, insects, rats, mice or other vermin, shall not react corrosively with equipment, piping or ductwork and shall be asbestos free.

PART 2 PRODUCTS

2.01 GENERAL

- A. Each insulation type shall be of one manufacturer.
 - 1. Fiberglass insulation manufacturers:
 - a. CertainTeed
 - b. Knauf Insulation
 - c. Johns Manville
 - d. Owens Corning
 - e. Or Approved.
 - 2. Elastomeric manufacturers:
 - a. Aeroflex USA
 - b. Armacell International
 - c. K-flex
 - d. Or Approved

PLUMBING INSULATION

2.02 PIPE INSULATION

- A. Elastomeric: Expanded closed cell, 0.27 per inch maximum K-factor at 75°F mean temperature and 220°F maximum service rating with fitting covers. Insulation shall meet ASTM C534 Type II, and NFPA 90A.
- B. Fiberglass Pipe Insulation: Split sectional or snap-on type with 0.23 per inch maximum thermal conductivity (K-factor) at 75°F mean temperature per ASTM C518, 500°F minimum service rating and white, vapor barrier jacket with pressure sensitive closure system. Insulation shall meet ASTM C585, NFPA 90A.

2.03 ACCESSORIES

- A. Adhesives:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
 - 2. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 3. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 4. Elastomeric: Solvent-based, contact adhesive recommended by insulation manufacturer.
- B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
- C. Staples: Outward clinching galvanized steel.
- D. Insulation Protection Saddles: 12-inch long, 16-gauge steel. Comply with ANSI/MSS SP-58 (Type 40).
- E. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd. 4-inches wide.
- F. Bands: 3/4 inch wide, Stainless Steel, ASTM A 666, Type 304; 0.020 inch thick.
- G. Wire: 0.062-inch, soft-annealed, stainless steel.
- H. Mastic: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates. Comply with MIL-C-19565C, Type II.

PART 3 EXECUTION

3.01 GENERAL

- A. Applicators: Applicators shall be employed by a firm that specializes in insulation work.
- B. Preparation: Surfaces of piping, equipment, and ductwork shall be clean, free of oil or dirt, and dry before insulation is applied.
- C. Stamps: ASME stamps, UL labels, and similar stamps and labels shall not be covered.
- D. Any insulation that becomes damaged, water soaked, or stained shall be replaced at no additional cost to the Owner.

3.02 PIPE AND EQUIPMENT APPLICATIONS

- A. Insulate the following piping systems with glass fiber insulation, all purpose jacket in thickness listed.
 - 1. Domestic hot water, above ground, 1-inch thick for piping 1-1/4 inches and smaller for first 8-feet from water heater.
- B. Insulate the following piping systems with elastomeric insulation in thickness listed:
 - 1. PEX piping for domestic hot water, 1-inch thick for piping 1-1/4 inches and smaller for first 8-feet from water heater.
- C. The following piping is not insulated: Waste and vent

PLUMBING INSULATION

- D. Insulation shall include all fittings, unions, flanges, mechanical couplings, valve bodies, valve bonnets, and piping through sleeves.
- E. Valves and irregular fittings shall be insulated with section of pipe insulation and insulating cement, securely fastened, and finished with 6 oz. canvas and Foster 30-36, or equal, lagging adhesive.
- F. Expansion Joints and Flexible Connectors: Pipe insulation or block of same material and thickness as adjacent piping.

3.03 PIPING INSTALLATION

- A. General:
 - 1. Joints: Coat both sides of complete joining area with applicable adhesive.
 - a. Longitudinal Joints: Make joints on top or back of pipe to minimize visibility. Except for foam plastic, seal with closure system or 3-inch-wide tape.
 - b. Butt Joints: Butt tightly together and, except for foam plastic, seal with 3-inch-wide tape or butt straps.
 - c. Multiple Layered Insulation: Joints shall be staggered.
 - 2. Access: Strainer and other items requiring service or maintenance with easily removable and replaceable section of insulation to provide access.
 - 3. Voids: Fill all voids, chipped corners, and other openings with insulating cement or material compatible with insulating material. In insulation with vapor barrier, coat with vapor barrier mastic.
 - 4. Seal joints, seams, and fittings of metal watertight jackets at exterior locations.
- B. Elastomeric Insulation:
 - 1. Slit full length and snap around pipe.
 - 2. Make cuts perpendicular to insulating surface leaving no cut section exposed.
 - 3. Do not stretch insulation to cover joints or fittings.
 - 4. Seal joints with adhesive. Sealing joints with tape will not be allowed.
 - 5. Exterior insulation shall be painted with two coats of specified paint in accordance with the manufacturer's instructions.
- C. Fittings: Insulation specified with continuous vapor barrier, the vapor barrier shall not be violated.
 - 1. On Elastomeric and Acoustical Insulation: Fittings covered with covers made up of mitered sections of insulation or with formed pipe fitting covers.
 - 2. In Other Insulation: Fittings covered with insulation to the same level of the adjoining insulation or fill with insulating cement. Finish with pipe fitting covers or cloth facing and tape.
- D. Unions, Flanges, Mechanical Joints, Valves, Etc:
 - 1. General: As specified for fittings. Minimum thickness same as specified for piping.
 - 2. Unions: Build up insulation at least 1/2 inch beyond adjoining insulation.
 - 3. Flanges: Insulation with square corners.
 - 4. Flanged Valves: Insulation with square corners.
- E. Non-Vapor Barriered Insulation:
 - 1. On piping 1 1/2 inches and smaller, insulation continuous through pipe hanger, with shield at each hanger.
 - 2. For all piping, insulation shall be protected with pipe shield specified in Section 230529, Hangers and Supports.

3.04 FIELD QUALITY CONTROL

- A. Field Test: All systems shall be tested and approved prior to installation of insulation.
- B. Existing Insulation:
 - 1. Repair existing insulation damaged during construction.

PLUMBING INSULATION

2. Make neat connections where new and existing insulation meet.
3. Where existing piping, or equipment is removed, cover existing surfaces neatly to match existing.

END OF SECTION

PLUMBING PIPING

PART 1 GENERAL

1.01 DESCRIPTION

- A. This section describes piping, pipe fittings, and incidental related items as required for complete piping systems, within 5-feet of the building footprint.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 220050, Basic Plumbing Requirements
- B. Section 220529, Hangers and Supports
- C. Section 220553, Plumbing Identification

1.03 REFERENCES

- A. ANSI: American National Standards Institute
- B. ASME: American Society of Mechanical Engineers
- C. ASTM: American Society for Testing and Materials
- D. AWWA: American Water Works Association
- E. CDA: Copper Development Association
- F. CISPI: Cast Iron Soil Pipe Institute
- G. IEEE: Institute of Electrical and Electronics Engineers
- H. NEC: National Electric Code
- I. UL: Underwriters Laboratories

1.04 SUBMITTALS

- A. Shop Drawings: For plumbing systems layout. Coordinate with the work of other divisions and existing facilities, systems, equipment, and components.
- B. Test Reports and Certificates: Certificates of inspections and pipe tests.
- C. Other: Certified welders' certificates.

1.05 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Piping material and installation shall meet requirements of the local plumbing, fire, and building codes and serving utility requirements.
 - 2. Provide chlorination of domestic cold and hot water piping in accordance with county and state health requirements.
- B. Pipe Cleaning: Should any pipe be plugged or should foaming of water systems occur, disconnect piping, reclean, and reconnect without additional expense to the contract.
- C. Correct any damage to the building or systems resulting from failure to properly clean the system without additional expense to the contract.

PART 2 PRODUCTS

2.01 PVC PIPE, SCHEDULE 40

- A. Pipe: Solid core, schedule 40 PVC pipe in accordance with ASTM D1784, D1785 and D2665
- B. Fittings: PVC DWV fittings in accordance with ASTM D1784 and D2665.
 - 1. Pressure rated fittings: Schedule 40 PVC fittings in accordance with ASTM D1784 and D2466.
- C. Glued Joints: Primer shall comply with ASTM F656. Solvent Cement shall comply with ASTM D2564.

PLUMBING PIPING

- D. Service:
1. Sanitary soil and waste to 5 feet outside building line, unless noted otherwise.
 2. Storm drainage to 5 feet outside building line.
 3. Vent piping, unless noted otherwise.

2.02 ABS PIPE, SCHEDULE 40

- A. Pipe: Foam core, schedule 40 ABS pipe in accordance with ASTM D3965 and F628
- B. Fittings: ABS DWV fittings in accordance with ASTM D2661 and D3965.
- C. Solvent Cement: Comply with ASTM D2235.
- D. Service:
1. Sanitary soil and waste to 5 feet outside building line, unless noted otherwise.
 2. Storm drainage to 5 feet outside building line.
 3. Vent piping, unless noted otherwise.

2.03 PEX

- A. Manufacturers: Subject to compliance with requirements, provide products by one the following:
1. Uponor
 2. Sioux Chief
 3. Zurn
 4. MrPex Systems
 5. Or Approved
- B. Tubing: ASTM F876 and ASTM F877 compliant PEX plastic.
- C. Fittings: ASTM F1960, cold expansion fittings and reinforcing rings. Do not use fittings or installation methods that void PEX manufacturer's standard system warranty
- D. Service: Domestic hot and cold water piping on piping 2- inches and smaller, unless otherwise noted on drawings. Trap priming lines.

2.04 COPPER TUBE

- A. Tubing: Hard drawn copper tubing, Type L ASTM B88.
- B. Fittings: Wrought copper, 150 psi, solder joint type.
- C. Service: Trap priming lines (Type L, annealed).

2.05 UNIONS

- A. Unions shall be 150 psi malleable iron or brass, brass to iron seat, ground joint, black or galvanized to match pipe. 200 psi WOG bronze, ground joint, solder type for copper tubing. Use of dielectric unions is not permitted.

2.06 JOINING MATERIALS

- A. Solder Filler Metals: ASTM B32, lead-free alloys. Include ASTM B813 water-flushable flux.
- B. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for copper to copper joints. Bag-1, silver alloy for copper to bronze or steel joints.

2.07 PIPING, HANGERS, SUPPORTS, ANCHORAGE, AND SEISMIC RESTRAINTS

- A. Conform to the requirements of Section 220529, Hangers and Supports; and Section 220548, Plumbing Vibration and Seismic Controls.

2.08 FLEXIBLE CONNECTORS

- A. Expansion Joint for Domestic Water Piping: UL classified for use in drinking water classifications in accordance with ANSI/National Sanitary Foundation 61 standard, bronze hose and braid with copper sweat ends.

PLUMBING PIPING

PART 3 EXECUTION**3.01 PREPARATION**

A. Measurements, Lines, and Levels:

1. Check dimensions at the building site and establish lines and levels for the work specified in this section.
2. Establish all inverts, slopes and manhole elevations by instrument, working from an established datum point. Provide elevation markers for use in determining slopes and elevations in accordance with the drawings and specifications.
3. Use established grid and area lines for locating trenches in relation to buildings and boundaries.

3.02 EXCAVATION AND BACKFILL

- A. Perform all necessary excavation and backfill required for the installation of plumbing work in accordance with Division 31. Repair pipelines or other work damaged during excavation and backfilling. Provide dewatering and temporary erosion control in accordance with Division 31.
- B. All PVC, ABS, PEX, steel, and copper piping shall be full bedded on sand. Place a minimum 4-inch-deep layer on the leveled trench bottom for this purpose. Remove the sand to the necessary depth for piping bells and couplings to maintain contact of the pipe on the sand for its entire length. Lay all other piping on a smooth level trench bottom, so that contact shall be made for its entire length.
- C. Buried PVC and ABS shall be installed in compliance with ASTM F1668 and ASTM F2321.

3.03 PIPING INSTALLATION

- A. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- B. Install PEX tubing according to Manufacturer's written installation instructions.
- C. Install unions in all non-flanged piping connections to apparatus and adjacent to all screwed valves, traps, and appurtenances requiring removal for servicing, located so that piping may be disconnected without disturbing the general system.
- D. Install all piping to vent and drain.
- E. Support all piping independently so that its weight is not carried by the equipment.
- F. Run piping clear of tube cleaning or removal/replacement access area on coils, etc.
- G. Install utility warning tape and locate wire over the entire length of the underground piping utilities.
- H. No-Hub Couplings: Install in accordance with the manufacturer's instructions.
- I. Route piping at right angles or parallel to building walls where exposed to building occupants. Route vent piping tight bottom of roof structure. Route domestic water piping tight to walls. Install piping to allow for valve servicing. Piping to be free of sags and bends.

3.04 PIPING JOINTS

- A. Join pipe and fittings using methods and materials recommended by the manufacturer, in accordance with standard practice and applicable codes. Cleaning, cutting, reaming, grooving, etc., shall be done with proper tools and equipment. Hacksaw pipe cutting is prohibited. Peening of welds to stop leaks is not permitted.
- B. Copper Tubing:
 1. Soldered Joints: Cut pipe evenly with cutter, ream to full inside diameter; end of pipe and inside of fitting thoroughly cleaned and polished. Joint shall be uniformly heated, and capillary space completely filled with solder, leaving full bead around entire circumference.

PLUMBING PIPING

- 2. Brazed Joints: All joints using mechanically extracted collars shall be brazed in accordance with the Copper Development Association's Copper Tube Handbook using B-cup series filler metal. Soft solder joints will not be accepted.
- C. Do not install couplings in floor, wall, or grade beam sleeves.
- D. Screwed Joints: Use Teflon tape or Teflon liquid dope applied to male threads only.
- E. Joints for PEX Tubing: Join according to ASTM F 1960 for cold expansion fittings and reinforcing rings.
- F. Steel Piping:
 - 1. Screwed Joints: Cut pipes evenly with pipe cutter, and ream to full inside diameter, with all burrs and cuttings removed. Joints shall be made up with suitable lubricant or Teflon tape, applied to male threads only, leaving two threads bare. Tighten joints so not more than two threads are left showing. Make junctions between galvanized steel waste pipe and bell of cast iron pipe with tapped spigot or half coupling on steel pipe to form spigot end, and caulk.

3.05 ADJUSTING AND CLEANING

- A. General:
 - 1. Clean interior of all piping before installation.
 - 2. Flush sediment out of all piping systems with a minimum velocity of 5 to 6 FPS.
 - 3. Prepare system for adjusting and balancing. If any system components, including control valves, balancing valves, automatic flow control valves, strainers, or other valves and specialties have sediment present, remove, clean and replace damaged or worn components.
- B. Domestic Water Chlorination:
 - 1. Chlorination of domestic cold and hot water piping shall be in accordance with county and state health requirements.
 - 2. Upon completion of all tests and necessary replacements, disinfect all domestic water piping. Chlorination shall be accomplished by personnel of firm licensed to do this type of work.
 - 3. The system shall be charged with a chlorine solution of at least 50 PPM residual chlorine. Evenly distribute the solution throughout the system. The strong chlorine solution shall remain in the system for a minimum of 24 hours. The strength of the solution shall be confirmed at over 10 PPM at the end of the 24 hour period.
 - 4. Submit bacteriological samples to a certified laboratory to test that the water is suitable for drinking. The laboratory's certificate stating purity of water shall be submitted to the Owner's representative.

3.06 TESTING

- A. Sanitary waste and vents: Test entire system or sections of system by closing all openings in piping except highest opening and filling system with water to point of overflow. If system is tested in sections, plug each opening except highest opening of section under test and fill each section with water, but none with less than 10-feet head of water. Keep water in system, or in portions under test, for at least 45 minutes before inspection starts. Test for two hours with no drop allowed. Locate and repair leaks.
- B. Potable water: 80-PSIG hydrostatic test pressure for a minimum 4-hours with no loss of pressure. Pneumatic testing can be used if system has no flexible braided hoses and is acceptable to the Authorities Having Jurisdiction. Locate and repair leaks.

END OF SECTION

PLUMBING FIXTURES

PART 1 GENERAL

1.01 DESCRIPTION

- A. This section describes plumbing fixtures, fixture trim, drainage products, and miscellaneous plumbing items.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 220050, Basic Plumbing Requirements

1.03 REFERENCES

- A. ADAG: Americans with Disabilities Act Guidelines
- B. ANSI: American National Standards Institute
- C. ASME: American Society of Mechanical Engineers
- D. ASSE: American Society of Sanitary Engineering
- E. ASTM: American Society for Testing and Materials
- F. NFPA: National Fire Protection Association
- G. NSF: National Sanitation Foundation

1.04 SUBMITTALS

- A. For each item specified on the plumbing connection schedule, submit product/material data; shop drawings; operation and maintenance data; as-constructed data; installation, startup, and testing manuals; operation and maintenance manuals; and as-constructed drawings.

1.05 QUALITY ASSURANCE

- A. All fixtures and fixture trim that will be in contact with potable water shall comply with NSF 61 Annex G and NSF 372.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
- C. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- D. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 - 1. Stainless-Steel: ASME A112.19.3.
 - 2. Floor drains: ASME A112.6.3
- E. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
 - 1. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3.
 - 2. Manual Faucets: ASME A112.18.1/CSA B125.1.
 - 3. Hose-Coupling Threads: ASME B1.20.7.
 - 4. NSF Potable-Water Materials: NSF/ANSI 61.
 - 5. Pipe Threads: ASME B1.20.1.
 - 6. Brass and Copper Supplies: ASME A112.18.1/CSA B125.1.
 - 7. Brass Waste Fittings: ASME A112.18.2/CSA B125.2.
- F. Comply with the following applicable standards and other requirements specified for shower faucets:
 - 1. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
 - 2. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
 - 3. NSF Potable-Water Materials: NSF/ANSI 61.

PLUMBING FIXTURES

4. Hose-Coupling Threads: ASME B1.20.7.
5. Pipe Threads: ASME B1.20.1.
- G. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
 1. Atmospheric Vacuum Breakers: ASSE 1001.
 2. Brass and Copper Supplies: ASME A112.18.1/CSA B125.1.
 3. Plastic Tubular Fittings: ASTM F 409.
 4. Brass Waste Fittings: ASME A112.18.2/CSA B125.2.
- H. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 1. Flexible Water Connectors: ASME A112.18.6.
 2. Hose-Coupling Threads: ASME B1.20.7.
 3. Off-Floor Fixture Supports: ASME A112.6.1M.
 4. Pipe Threads: ASME B1.20.1.
 5. Supply and Drain Protective Shielding Guards: ICC A117.1

PART 2 PRODUCTS**2.01 PLUMBING FIXTURES**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 1. Trench Drains: Zurn #Z883-E1-HPB-VP-DB with bottom outlet, bronze grate, dome strainer, vandal-resistant lockdown. Coordinate outlet size with existing conditions and Architect's requirements. Coordinate exact grate option with Architect prior to ordering.
- B. Acceptable Manufacturers - Fixtures
 1. Floor Drains: JR Smith, Oatey, Sioux Chief, Watts, Zurn, or approved. Body material to match waste system.
 2. Clean outs: JR Smith, Sioux Chief, Zurn or approved.
 3. Trench Drains: Zurn, JR Smith, ACO, Watts, or approved.
 4. Metal bellows water hammer arrestors: JR Smith, Precision Plumbing Products, Watts or approved.
 5. Trap Primer Valves: Precision Plumbing Products, Sioux Chief, Zurn or approved.
 6. Security fixtures: Acorn Engineering, Willoughby, or approved.

PART 3 EXECUTION**3.01 FIXTURE TRIM**

- A. Provide plumbing fixture trim where applicable on fixtures.
- B. Provide rough-in and final piping connection to fixtures. Carefully review all construction documents to assure that all fixtures are provided with necessary services for a complete operating system.
- C. Rigidly secure rough-in piping, carriers and supports, and other service piping to structure.

3.02 PLUMBING FIXTURES

- A. Americans with Disabilities Act: Those fixtures indicated by "ADA" shall comply with and be installed in accordance with Americans with Disabilities Act Guidelines (ADAG). Where applicable building code requirements are more stringent than ADAG guidelines, building code requirements shall be followed.
- B. Mounting Heights: All fixtures shall be standard rough-in catalogued heights unless shown otherwise on the drawings.
- C. Water Supplies: When both hot and cold water to a fixture is required, connect the hot on the left and the cold on the right.

PLUMBING FIXTURES

- D. Sinks: Provide insulation kits on exposed hot water and waste piping beneath lavatories.
- E. Trench/Floor Drain:
 - 1. Set top flush with finished floor.
 - 2. Provide membrane clamp where required.
- F. Cleanout: Cover set flush with finished surface.
- G. Shock Arresters: Provide per manufacturer's recommendation as shown on drawings by PDI, whichever is more stringent. Install shut off valve to isolate shock arrester for future maintenance. Valve shall normally be in the open position.

3.03 PRIMING VALVES

- A. Floor drain traps shall be primed from priming valves with 3/8-inch copper pipe.
- B. Where priming valves are installed in finished rooms, conceal in wall and provide access panel.
- C. Coordinate locations of electronic trap primer stations with the Owner's Representative.
- D. Coordinate locations of electronic trap primer stations to obtain 120V service.

3.04 PLUMBING VENTS

- A. Provide vents to outdoors for fixtures requiring plumbing vents according to code and as indicated.

3.05 TESTING

- A. Check out, start up, and test the following items: Mixing valves.

END OF SECTION

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SECTION 23 00 50

BASIC MECHANICAL REQUIREMENTS

PART 1 GENERAL**1.1 DESCRIPTION**

- A. The intent of the Division 23 specifications and the accompanying drawings is to provide complete and workable systems as shown, specified and required by applicable codes. Include all work specified in Division 23 and shown on the accompanying drawings. The following requirements are included in this Section to expand the requirements specified in Division 01.

1.2 REFERENCES

- A. FM: FM Global
B. NEMA: National Electrical Manufacturers Association
C. OR-OSHA: Oregon Occupational Safety and Health Administration

1.3 SUBMITTALS

- A. Follow the procedures outlined below and as specified in Division 01.
- B. Submit for approval, submittal documents as required in each Specification Section.
1. Submit all shop drawings and product data grouped to include submittals of related systems, products, and accessories in a single electronic submittal in PDF format.
 2. Each submittal shall be indexed according to Specification Section.
 3. Each Specification Section shall be a separate file.
 4. Create PDFs at native size and right-side up; illegible files and secured files will be rejected.
 5. Mark dimensions and values in units to match those specified.
 6. Include equipment mark numbers matched to drawing schedules.
 7. If hard copies are specifically requested in Division 01, they shall be indexed according to Specification Section and bound in a three-ring binder.
 8. Provide sample start-up sheets for HVAC equipment.
- C. No apparatus or equipment shall be shipped or fabricated until submittal documents for same have been reviewed and accepted.
- D. Submittals not requested will not be recognized or reviewed.
- E. Proposed Products List: In addition to the requirements of individual specification sections, include the following:
1. Manufacturer's name and address
 2. Catalog designation or model number.
 3. Equipment schedule number (cross referenced from drawings).
 4. Rough-in data and dimensions
 5. Performance curves and related capacities
 6. Airborne noise levels.
 7. Detailed point-by-point control drawings, including manufacturers catalog numbers of all devices and description of all components cross referenced to the control drawings. Include sequence of operation.

BASIC MECHANICAL REQUIREMENTS

1.4 QUALITY ASSURANCE

- A. Materials and equipment shall be new. Work shall be of good quality, free of faults and defects.
- B. All equipment shall fit in the space provided.
- C. Systems shall be built and installed to deliver their full rated capacity at the efficiency for which they were designed.
- D. HVAC systems shall operate at full capacity without objectionable noise or vibration.
- E. Materials and Equipment:
 - 1. Each piece of equipment provided shall meet all detailed requirements of the drawings and specifications and shall be suitable for the installation shown.
 - 2. Where two or more units of the same class of equipment are provided, use products of the same manufacturer; component parts of the entire system need not be products of the same manufacturer.
- F. Workmanship:
 - 1. Install all materials in a neat and workmanlike manner.
 - 2. Follow manufacturer's directions. If they are in conflict with the contract documents, obtain clarification before starting work.
- G. Cutting and Patching:
 - 1. Cutting, patching and repairing for the proper installation and completion of the work specified in this division, including plastering, masonry work, concrete work, carpentry work, firestopping, and painting, shall be performed by skilled craftsmen of each respective trade in conformance with the appropriate division of work. Additional openings required in building construction shall be made by drilling or cutting.
 - 2. Fill holes which are cut oversize so that a tight fit is obtained around the objects passing through.
 - 3. Do not pierce beams or columns without permission of the Architect and then only as directed.
 - 4. New or existing work that is cut or damaged shall be restored to its original condition. Where alterations disturb existing finishes, the surfaces shall be repaired, refinished and left in condition existing prior to commencement of work.

1.5 SPECIFICATIONS COMPLIANCE

- A. The requirements of these specifications shall be complied with in every respect. Therefore, it shall be mandatory that the job foreman, all lead mechanics, subcontractors and their foreman have completely studied these specifications, be completely knowledgeable as to their entire contents, and maintain a copy at the job-site. Failure to comply with this requirement will be reason to presume the foreman, lead mechanic or subcontractor is not in responsible charge of their work due to ignorance of job requirements, and will be reason for the Owner to require dismissal and replacement with approved personnel. Every foreman and lead mechanic shall be provided with a complete copy of this specification.
- B. Enlarged scale plans, sections, and details shall take precedence over small scale plans.

BASIC MECHANICAL REQUIREMENTS**1.6 STANDARD SPECIFICATIONS**

- A. The chemical and physical properties of all materials and the design performance characteristics and methods of construction of all items of equipment shall be in accordance with the requirements of the latest issue of the various applicable Standard Specifications at the time of bid.

1.7 CONTRACT DOCUMENTS

- A. Contract Documents for Work are in part diagrammatic, intended to convey the scope of work and indicate general arrangement of equipment, piping and approximate sizes and locations of equipment and outlets. They do not show every offset, bend, tee, or elbow which may be required to install work in the space provided and avoid conflicts. Do not scale the Contract Documents for measurements.
- B. Outlets or equipment shown on the Drawings with no indication shall be completed in the same method and manner as similar outlets or equipment shown on the Drawings.
- C. The Contractor shall follow the Contract Documents in laying out the work, to become familiar with all conditions affecting the work and shall verify all spaces in which the work will be installed.
- D. Where job conditions require reasonable changes in indicated locations or arrangements, make changes without additional cost to the Owner.
- E. The Contract Documents and Specifications are to be cooperative and whatever is called for by either shall be binding as if called for by both.

1.8 USE OF EQUIPMENT

- A. The use of any equipment or any part thereof, for purposes other than startup and testing shall be prohibited.

1.9 PLACEMENT OF ORDERS

- A. No consideration will be given to requests for substitutions because of delivery problems or failure to order equipment in a timely manner.

1.10 RECORD DOCUMENTS

- A. Prepare record documents in accordance with the requirements in Division 01. In addition to the requirements specified in Division 01, indicate the following installed conditions:
- B. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., strainers, expansion compensators, tanks, etc.). Valve locations diagrams, complete with valve tag chart.
- C. Equipment locations (exposed and concealed), dimensioned from prominent structural building lines.
- D. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

1.11 OPERATION AND MAINTENANCE MANUALS (O&M)

- A. Prepare operation and maintenance manuals in accordance with Division 01. In addition to the requirements specified in Division 01, include the following information for equipment items:

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BASIC MECHANICAL REQUIREMENTS

1. O&M Manuals, including shop drawings, shall be indexed according to Specification Section.
 2. Each Specification Section and Drawing Discipline shall be a separate file.
 3. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
 4. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
 5. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and re-assembly; aligning and adjusting instructions.
 6. Servicing instructions and lubrication charts and schedules.
- B. Maintenance manuals shall be submitted and approved prior to any system functional testing.
- C. Manuals shall be project specific.

PART 2 PRODUCTS**2.1 ACCESS PANELS**

- A. Comply with the requirements of Division 08.
- B. Access panels shall be minimum 18 inches by 18 inches in ceilings soffits and shafts, and minimum 12 inches by 12 inches in walls, unless indicated otherwise.
- C. Provide access panels where indicated and where required to access valves, fire dampers, trap primers, shock arresters, and other appurtenances requiring operation, service, or maintenance. Review locations prior to installation.

2.2 DUCT SLEEVES

- A. Interior Wall and Floor Sleeves: 18 gauge galvanized steel.

2.3 FLOOR, WALL, AND CEILING PLATES

- A. Provide stamped one-piece spun aluminum for round duct penetrations.

2.4 SEALANT

- A. Comply with requirements in Division 07. Sealants to be suitable for materials joined and application.

2.5 MACHINERY GUARDS

- A. Provide guards for protection on all rotating and moving parts of equipment.
- B. Provide shaft holes in guards for easy use of tachometers at shaft centers. Guards shall be easily removable.
- C. All guards shall meet OR-OSHA requirements including back plates.

2.6 ELECTRICAL EQUIPMENT

- A. General: All equipment and installed work shall be as specified under Division 26, Electrical.

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BASIC MECHANICAL REQUIREMENTS

B. Motors:

1. Motors shall be furnished as integral part of driven equipment. Motors shall be completely enclosed, fan cooled induction type with sealed ball bearings. Motors 1 hp and above shall be NEMA Premium Efficiency type except for emergency equipment motors, sump pumps, and sewage ejector pump motors. Motors shall be built to NEMA standards for the service intended. The motors shall be rated for the voltage specified, suitable for operation within the range of 10 percent above to 10 percent below the specified voltage.
2. Designed for a synchronous speed of 1800 rpm unless specified otherwise.
3. Motors 1/3 hp and Below: 1-phase, 60 cycle ac, 115V unless specifically noted otherwise, complete with integral thermal protection.
4. Have built-in thermal overload protection, or be protected externally with separate thermal overload devices with low-voltage release or lockout. Hermetically sealed motors shall have quick trip devices.
5. Life expectancy of bearings shall exceed 100,000 hours of direct couple and 40,000 hours with belt.
6. Motors controlled by variable speed drives shall be inverter duty rated and shall have a Class F insulation or better. Motors shall be able to withstand repeated voltage peaks of 1600 volts with rise times of 0.1 microseconds and greater, in accordance with NEMA Standard MG1, Part 31.
7. Motors served from variable frequency drives shall be equipped with a shaft grounding system utilizing brush grounding kits to provide a path for current to flow between the shaft and the motor frame.
8. Frequency drive manufacturers shall provide necessary filters and line reactor type equipment to protect motors from excessive voltage spikes that may exceed insulation requirements of NEMA MG1, Part 31.
9. Motors shall have a three year warranty.

C. Starters: See Division 26, Electrical. Starters shall be suitable for performing the control functions required, with the exception of self-contained equipment and where the starters are furnished as part of the control package.

D. Equipment Wiring: Interconnecting wiring within or on a piece of mechanical equipment shall be provided with the equipment unless shown otherwise. This does not include the wiring of motors, starters and controllers specified in Division 26, Electrical.

E. Control Wiring: All control wiring for HVAC equipment (circulating pumps, sump pumps, etc.) shall be as specified in Division 26.

PART 3 EXECUTION**3.1 PROJECT CONDITIONS**

- A. Coordinate exact requirements governed by actual job conditions. Check all information and report any discrepancies before fabricating work. Report changes in time to avoid unnecessary work.

3.2 COOPERATION WITH OTHER TRADES

- A. The Contractor shall cooperate with other trades to avoid interferences in the work and to avoid delays in the construction.

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BASIC MECHANICAL REQUIREMENTS

- B. Interference, which occurs as a result of poor coordination or lack of cooperation, shall be corrected at the Contractor's expense.

3.3 DAMAGE TO OTHER WORK

- A. The Contractor shall be held responsible for damage done to existing equipment, structures, pipes, etc., which damage is a direct or indirect result of their work. Such damage will be repaired at the expense of the Contractor.

3.4 EXISTING SERVICES

- A. When active sewers, gas, water, electric, telephone or other services are encountered in work, protect, brace or support, as required for proper execution of work. Do not disturb or prevent operation of active services that are to remain.
- B. Existing utility interruptions are only permitted under the following conditions:
 - 1. Arrangement to provide temporary utility services, in accordance with Utility Provider's requirements.
 - 2. Notification to the Owner's Representative not less than seven days in advance of proposed interruptions.
 - 3. Owner's written permission for proposed interruption.

3.5 DEMOLITION AND SALVAGE

- A. Remove or relocate piping, wiring, devices and other equipment encountered in existing areas affected by this work as indicated on the drawings. Status of items not indicated for demolition on the drawings shall be verified with the Owner's Representative.
- B. Protect equipment identified to be salvaged. Remove salvaged equipment prior to demolition of adjacent services. Arrange with the Owner's Representative for storage and return of salvaged equipment.
- C. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations. Prior to demolition, verify that demolished services will not affect the operation of existing systems that are to remain and notify the Architect.
- D. Demolition Service/System Requirements:
 - 1. Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical systems serving areas to be selectively demolished.
 - 2. Demolish all service back to nearest active main or point of future connection as indicated. Verify with Architect extent of demolition prior to proceeding if extent is not clear.
 - 3. The Architect will arrange to shut off indicated services/systems when requested by the Contractor.
 - 4. Where demolished systems contain refrigerant or another regulated chemical, the systems shall be drained with contents captured and properly disposed of prior to demolishing the system. Coordinate with the Architect regarding environmental regulations.
 - 5. If services/systems are required to be removed, relocated, or abandoned: Before proceeding with selective demolition, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.

BASIC MECHANICAL REQUIREMENTS

6. Remove all accessories associated with removed utilities including supports, hangers, braces, clips, etc., in their entirety.
7. Patch penetrations of walls and floors related to demolished services restoring existing fire separations, assembly ratings, and waterproofing membranes.

3.6 SYSTEM WATER DISPOSAL

- A. Do not drain water from systems treated with chemicals into the sanitary or storm sewers without written approval from the Owner's Representative.

3.7 REFERENCE TO DESIGN SCHEDULES

- A. The Contractor shall refer to Equipment Schedules for Drawing unit identification number and corresponding area locations, capacity and design requirements.
- B. After the equipment or materials have been installed and tested under operating conditions, if it is found that they do not meet the requirements specified, the Contractor shall remove all such equipment and/or materials that do not meet the specified conditions and replace them with the proper equipment without additional cost to the Owner.

3.8 EQUIPMENT INSTALLATIONS AND DESIGN

- A. Certain equipment may need to be installed before enclosures are installed or completed. Doors and other access openings, in some case, may not be large enough to permit passage of the equipment completely assembled.
- B. Investigate and coordinate these conditions prior to fabrication or shipment.
- C. Make provisions for the necessary openings in the building to allow for admittance of all equipment.
- D. Where two or more units of the same class of equipment are required, these units shall be the product of a single manufacturer.
- E. Equipment and accessories not specifically described or identified by manufacturer's catalog numbers shall be designed in conformity with applicable technical standards, suitable for maximum working conditions and shall have a neat and finished appearance.

3.9 EQUIPMENT SCHEDULE

- A. The Equipment specified is intended to indicate the quality and type of equipment to be supplied.
- B. Where the Specifications vary from the schedules, the more stringent shall apply.
- C. All packaged unit equipment and skid mounted HVAC components that are factory assembled shall meet, in detail, the products named and specified.

3.10 EQUIPMENT INSTALLATION

- A. The Contractor shall coordinate the delivery of the equipment with other trades.
- B. The Contractor shall provide the equipment in a suitable knocked down condition for placement in the structure as dictated by available access.
- C. Any costs incurred by the failure of the Contractor to comply with the above shall be at the Contractor's expense.

3.11 ACCESS PANELS

- A. Install in accordance with manufacturer's recommendations, coordinated with architectural features. Review intended locations with the Architect prior to installation.

BASIC MECHANICAL REQUIREMENTS**3.12 SLEEVES**

- A. General:
 - 1. Lay out work prior to concrete forming. Do all cutting and patching required. Reinforce sleeves to prevent collapse during forming and pouring.
- B. Interior Wall Sleeves:
 - 1. Pack with fiberglass insulation.
 - 2. Terminate sleeve flush with face of wall unless indicated otherwise.
- C. Above-Grade Exterior Wall Sleeves: Similar to interior wall sleeves, except caulk outside with sealant.
- D. Sleeves Through Fire-Rated Floors: Install the same as sleeves through floors, except:
 - 1. Make penetrations through floor watertight by sealing gap between sleeve and floor with floor penetration sealant as specified in Part 2, and
 - 2. Provide firestopping system both inside and outside of sleeve as specified in Division 07, and in accordance with the recommendations of FM Global.
- E. Sleeves Through Fire-Rated Walls: Provide firestopping system as specified in Division 07, and in accordance with the recommendations of FM Global.

3.13 FIRESTOPPING

- A. Comply with the requirements of Division 07.
- B. Provide fire-rated assemblies at all penetrations of 1 hour or more.

3.14 CLEANING

- A. Clean HVAC equipment, piping and ductwork of stampings and markings (except those required by codes), iron cuttings, and other refuse.
- B. Clean scratched or marred painted surfaces of rust or other foreign matter and paint with matching color industrial enamel, except as otherwise noted.

3.15 EQUIPMENT PROTECTION

- A. Keep pipe, ductwork and conduit openings closed by means of plugs or caps to prevent the entrance of foreign matter. Protect piping, conduit, ductwork, fixtures, equipment, and apparatus against dirty water, chemical, or mechanical damage both before and after installation. Restore damaged or contaminated piping, fixtures, equipment, or apparatus to original conditions or replace at no additional cost to the Owner.
- B. Protect bright finished shafts, bearing housings, and similar items until in service. No rust will be permitted.
- C. Cover or otherwise suitably protect equipment and materials stored on the job site.
- D. Provide filters at all openings in operating systems on return or exhaust ductwork.

3.16 ACCESSIBILITY

- A. Conveniently locate control panels, hardware and devices, valves, thermometers, gauges, cleanout fittings, and other equipment or specialties requiring frequent reading, adjustments, inspection, repairs, or removal and replacement.
- B. Install thermometers and gauges to be easily read from floors, platforms, and walkways.

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SECURITY IMPROVEMENTS

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BASIC MECHANICAL REQUIREMENTS

- C. Provide 36 inches clear access space on each side of variable and constant volume terminal units containing control valves, actuators, electrical disconnect, and DDC controls. Coordinate with other trades the locating of light fixtures, fire sprinkler piping, as well as other equipment, piping, and conduit to avoid obstructing access to serviceable components of terminal units. Provide access panels in linear metal, wood slat, gypsum board, or other hard ceilings to permit convenient access to terminal units.
- D. Provide access panels in linear metal, wood slat, gypsum board, or other hard ceilings and walls to permit convenient access isolation, emergency shut-off, and other valves.

3.17 FLOOR, WALL AND CEILING PLATES

- A. Install plates on piping passing through finished walls, floors, ceilings, partitions and plaster furrings. Plates shall completely cover opening around pipe and duct.
- B. Secure wall and ceiling plates to pipe, insulation, or structure.
- C. Plates shall not penetrate insulation vapor barriers.
- D. Plates are not required in mechanical rooms or unfinished spaces.

3.18 ELECTRICAL EQUIPMENT

- A. No piping, ducts, leak protection apparatus, or other equipment foreign to the electrical installation shall be located in the dedicated electrical space around electrical equipment.
- B. The area above the dedicated electrical space shall be permitted to contain foreign systems, provided protection is installed to avoid damage to the electrical equipment from condensation, leaks, or breaks in such foreign systems.
- C. Unions in mechanical piping shall not be installed in dedicated electrical or IT spaces, or above or below ceilings.
- D. Low point drains in mechanical piping shall not be installed in dedicated electrical or IT spaces, or above or below ceilings. If this cannot be avoided, the low point drain connection shall be extended outside of the electrical or IT space.
- E. Protect outdoor electrical equipment from accidental spillage or leakage from piping systems.

3.19 EQUIPMENT CONNECTIONS

- A. Make final connections to equipment in accordance with manufacturer's instructions, shop drawings, and as indicated.
- B. Piping:
 - 1. Connections shall include hot and cold water, fuel and gas, compressed air, sanitary waste and vent, roof and overflow roof drains, and liquid grease.
 - 2. Provide easily accessible unions and gate valves in all piping at equipment, waste traps, and any other fittings required for complete installation.
 - 3. Piping connections shall be independently supported to prevent undue strain on equipment.

3.20 PAINTING

- A. Comply with the requirements of Division 09.
- B. Equipment Rooms and Finished Areas:
 - 1. Insulation: Not painted.
 - 2. Hangers, Uninsulated Piping, Miscellaneous Iron Work, Structural Steel Stands, Uninsulated Tanks, Equipment Bases: Paint one coat of black enamel.

BASIC MECHANICAL REQUIREMENTS

3. Equipment Without Factory Finish: Paint one coat of grey machinery enamel. Do not paint nameplates.
 4. Grilles, Diffusers, Registers: Paint sheet metal and visible ductwork behind grilles, diffusers, and registers flat black.
 5. Galvanized Ductwork: Not painted, except as noted on plans.
- C. Concealed Spaces (above ceilings, not visible):
1. Insulation: Not painted.
 2. Hangers, Uninsulated Piping, Miscellaneous Iron Work, Valve Bodies and Bonnets: Not painted.

3.21 POWDER-ACTUATED FASTENERS

- A. Powder-actuated fasteners are not allowed.

3.22 ADJUSTING AND CLEANING

- A. Before operating equipment or systems, make thorough check to determine that systems have been flushed and cleaned as required and equipment has been properly installed, lubricated, and serviced. Check factory instructions to see that installations have been made properly and that recommended lubricants have been used.
- B. Use particular care in lubricating bearings to avoid blowing out seals from over-lubrication. Check equipment for damage that may have occurred during shipment, after delivery, or during installation. Repair damaged equipment or replace with new equipment when approved by the Owner's Representative.

3.23 OPERATING INSTRUCTIONS

- A. Instruct the Owner's personnel in the care, operation and maintenance of all apparatus and equipment. Instructions shall be given verbally at the job site by a qualified, experienced representative of the Contractor.
- B. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use. Digital format to comply with Owner's requirements.

END OF SECTION

HANGERS AND SUPPORTS

PART 1 GENERAL**1.01 DESCRIPTION**

- A. This section describes the following:
 - 1. Hangers, supports, and anchors for equipment, tanks, ductwork, and piping systems.
 - 2. Supplementary steel for support or attachment of tanks, equipment, ductwork, and piping to general construction elements of the project.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 230545, Vibration and Seismic Controls
- B. Section 230713, Mechanical Insulation

1.03 REFERENCES

- A. ASHRAE: American Society of Heating, Refrigerating and Air-Conditioning Engineers
- B. ASTM: American Society for Testing and Materials
- C. CISPI: Cast Iron Soil Pipe Institute
- D. OSSC: Oregon Structural Specialty Code
- E. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association

1.04 SUBMITTALS

- A. Product Data: For all products specified herein.
- B. Shop Drawings:
 - 1. Submit shop drawings of Contractor-fabricated piping support structures, pipe racks, and anchors.
 - 2. Suspended Piping and Ductwork: Indicate point loads and support locations, along with applicable details keyed to layouts.
 - 3. Support Frames, Piping, Tank, and Equipment Supports, and Anchorage: Indicate point loads and support locations, along with engineers' calculations and details keyed to the layouts pertaining to supports, support frames, and anchorages.
 - 4. Supplementary Steel: Show details of fabrication and installation. Indicate materials, thicknesses, gauges, sizes, dimensions, methods of joining and fastening, welds, finishes, details of reinforcement and embedment, attachments, anchorages, miscellaneous metal items incidental to basic fabrication shown, provisions for work of other trades, and other pertinent information. Submit structural calculations for necessary supplementary steel for supports, anchors, and attachment of equipment, pipes, and ducts to general construction. Calculations shall be prepared and stamped by a registered professional structural engineer licensed in the state of Oregon.
 - 5. As-Constructed Drawings and Data.

1.05 QUALITY ASSURANCE

- A. Supports and hangers for piping systems subject to expansion and contraction shall be chosen with careful consideration. The hanger support type selection depends on the directions in which the piping system will expand.

HANGERS AND SUPPORTS

PART 2 PRODUCTS**2.01 SEISMIC AND WIND REQUIREMENTS**

- A. Seismic Design Calculations:
 - 1. Perform calculations to obtain force information necessary to properly select seismic-restraint devices, fasteners, and anchorage. Perform calculations using methods acceptable to applicable code authorities and as presented in ASCE/SEI 7-16. Where "ASCE/SEI 7" is used throughout this Section, it is to be understood that the edition referred to in this subparagraph is the edition intended as reference throughout the Section Text.
 - a. Data indicated below to be determined by Delegated-Design Contractor must be obtained by Contractor and must be included in individual component submittal packages.
 - b. Coordinate seismic design calculations with wind-load calculations for equipment mounted outdoors. Comply with requirements in other Sections in addition to those in this Section for equipment mounted outdoors.
 - c. Building Risk Category: See Structural Drawings.
 - d. Building Site Classification: See Structural Drawings.
 - e. Component Importance Factor: 1.0 (Except for Natural Gas which is 1.5)
 - f. Component Response Modification Factor: Per ASCE 7.
 - g. Component Amplification Factor: per ASCE 7.
 - h. Design Spectral Response Acceleration at Short Periods (0.2 Second): See Structural Drawings.
 - i. Design Spectral Response Acceleration at 1.0-Second Period: See Structural Drawings.
- B. Consequential Damage: Provide additional seismic restraints for suspended HVAC components or anchorage of floor-, roof-, or wall-mounted HVAC components as indicated in ASCE/SEI 7-16 so that failure of a non-essential or essential HVAC component will not cause failure of any other essential architectural, mechanical, or electrical building component.

2.02 SUPPORTS AND ANCHORAGE

- A. Provide pipe, ductwork, and equipment hangers and supports in accordance with the following:
 - 1. When supports and anchorages for tanks, equipment, conduit, piping, and ductwork are not shown on the drawings, the Contractor shall be responsible for their design.
 - 2. Supports and anchorages shall resist forces due to hydraulic testing and seismic forces as specified in the OSSC for the ground motion accelerations corresponding to the project location. Exterior equipment, ducts, and piping shall be designed to resist wind loads.
 - 3. Supports and anchorages shall not introduce stresses in the piping caused by thermal expansion or contraction.
 - 4. Connections to structural framing shall not introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.
- B. The following engineered support systems shall be designed, detailed, and bear the seal of a registered professional structural engineer licensed in the state of Oregon:
 - 1. Supports, floor and roof-mounted tanks, and supports for suspended tanks and equipment.
 - 2. Support frames, such as pipe racks or stanchions, for piping and equipment which provide support from below.
 - 3. Tank, equipment, and piping support frame anchorage to supporting slab or structure.
- C. Ductwork Hanger Materials: Galvanized sheet steel or Cadmium-plated steel rods and nuts.
 - 1. Hangers Installed in Corrosive Atmospheres: Stainless steel, all-thread rods.
 - 2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.

HANGERS AND SUPPORTS

3. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
 4. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
 5. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
 6. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- D. Fire/Smoke Resistance: Seismic- and wind-load-restraint devices that are not constructed of ferrous metals must have a maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested by an NRTL in accordance with ASTM E84 or UL 723, and be so labeled.
- E. Component Supports:
1. Load ratings, features, and applications of all reinforcement components must be based on testing standards of a nationally recognized testing agency.
 2. All component support attachments must comply with force and displacement resistance requirements of ASCE/SEI 7-16 Section 13.6.

2.03 SUPPORTS, GENERAL

- A. Available Manufacturers: B-Line Systems, Anvil, Superstrut, Unistrut, or Approved.
- B. Fabricate support members from welded standard structural shapes, pipe, and plate. Carry the necessary rollers, hangers, and accessories as required. Piping less than 4-inch pipe size may be supported from or by prefabricated roll-formed channels as specified in this section with necessary accessories to adequately support piping system.
- C. Supports and Accessories: Preformed roll-formed channels and accessories with matching compatible accessories as shown, as specified, and as required.
- D. Dissimilar Metal Protection: Cush-a-Strip, Hydra-Zorb cushions, B-line ISO pipe isolator, or Approved.
- E. Attachments to roof and floor decks to support dead loads are not allowed except as described in Part 3. Attachments to decks to support transient loads shall consider the effects of deck deflection.
- F. All exterior materials shall be hot-dip galvanized or stainless steel.

2.04 PIPE ATTACHMENTS

- A. Clamps: MSS SP-58, Type 26, two bolt pipe strap clamp.
- B. Uninsulated Horizontal Piping: MSS SP-58, Type 1, clevis hanger.
- C. Riser Clamps, Steel and Cast Iron Pipe: MSS SP-58, Type 8. Clamp material shall be suitable for piping.

2.05 BUILDING ATTACHMENTS

- A. Beam Hangers – Beam Clamps: MSS SP-58, Type 30, adjustable malleable iron beam clamp, or MSS SP-58, Type 28 or 29, adjustable forged steel beam clamp.
- B. Beam Hangers – C-Type Clamps: MSS SP-58, Type 19 or 23. Sized for required rod to support load being carried.
- C. Beam Hangers – Welded: MSS SP-58, Type 22. Sized for required rod to support load being carried.

HANGERS AND SUPPORTS

- D. Post-installed concrete anchors:
1. Mechanical Anchor Bolts:
 - a. Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength for anchor and as tested according to ASTM E488/E488M.
 2. Adhesive Anchor Bolts:
 - a. Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E488/E488M.
 3. Provide post-installed concrete anchors that have been prequalified for use in wind-load applications. Post-installed concrete anchors must comply with all requirements of ASCE/SEI 7-16, Ch. 13.
 - a. Prequalify post-installed anchors in concrete in accordance with ACI 355.2 or other approved qualification testing procedures.
 - b. Prequalify post-installed anchors in masonry in accordance with approved qualification procedures.
- E. Provide preset concrete inserts that are seismically prequalified in accordance with ICC-ES AC408 testing. Inserts to comply with MSS SP-58.

2.06 PIPE ANCHORS

- A. Fabricate from steel plate as detailed by the Engineer. Use of premanufactured pipe anchors is acceptable when designed for by the Engineer.

PART 3 EXECUTION**3.01 HANGERS AND SUPPORTS**

- A. General:
1. Install all support systems as detailed and in accordance with manufacturer's recommendations. Provide pipe racks, pipe stands, trapeze hangers, etc., as required and as detailed on the drawings.
 2. Provide adjustable hangers complete with inserts, adjusters, bolts, nuts, swivels, all-thread rods, etc., for all pipes, except where specified otherwise.
 3. Size hangers to clear insulation for piping services conveying liquids less than 70°F.
 4. Support fire protection piping independently of other piping.
 5. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
 6. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
- B. Ductwork hangers and supports:
1. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
 2. Support vertical ducts at maximum intervals of 16 feet and at each floor.
 3. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

HANGERS AND SUPPORTS

C. Vertical Piping:

1. Support with U-clamps fastened to wall to hold piping away from wall unless otherwise approved.
2. Riser clamps shall be directly under fitting or welded to pipe.
3. Risers shall be supported at each floor of penetration.
4. Provide structural steel supports at the base of pipe risers. Size supports to carry all forces exerted by piping system when systems are in operation.

D. Horizontal Piping:

1. On all insulated piping, provide insulation protection shields at all roller locations.
2. Install hangers outside of insulation, provide insulation protection shields at each hanger location.

E. Trapeze Hangers: Multiple pipe runs where indicated shall be supported on channels with rust resistant finish. Provide all necessary supporting steel.

1. Channels: Unistrut with electro-chromate finish, or equal.

F. Hanger Spacing: Provide hangers at minimum spacing in accordance with Chapter 41, ASHRAE Guide and as follows:

1. Steel Pipe, Copper Tubing: For straight runs of horizontal piping with no concentrated loads such as valves, flanges, expansion joints, or other components. Sections of piping with concentrated loads will have to be considered carefully and a determination made as to appropriate spacing and rod size for the given situation.

<u>Pipe Size</u>	<u>Max. Span</u>	<u>Max. Span</u>	
	<u>Steel</u>	<u>Copper</u>	<u>Rod Size</u>
1" and smaller	7 feet	5 feet	3/8"
1-1/4" to 2"	8 feet	7 feet	3/8"
2-1/2" to 3"	11 feet	9 feet	1/2"

2.

3. Maximum Rod Load: Below are maximum loads for hanger rods based on Chapter 41 of ASHRAE Guide and as follows for ASTM A36, with a safety factor of 5.

<u>Nominal Rod Diameter</u>	<u>Load</u>
3/8"	610 pounds
1/2"	1,130 pounds
5/8"	1,810 pounds
3/4"	2,710 pounds

G. Building Attachments:

1. Where possible, support all piping and equipment from structural members, beams, and joists. If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
2. Provide structural steel angles, channels, or other members to support piping and equipment where structural members do not occur as required for proper support.
3. Arrange supports to prevent eccentric loading of joists and joist girders. Locate supports at joist panel points or provide web reinforcing as required.
4. Piping Restraints:
 - a. Comply with requirements in MSS SP-127.
 - b. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.

HANGERS AND SUPPORTS

- c. Brace a change of direction longer than 12 feet.
- d. Bracing shall not introduce stresses in the piping system caused by thermal expansion or contraction.
- 5. Mechanical Anchor Bolts:
 - a. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - b. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - c. Wedge-Type Anchor Bolts: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - d. Adhesive-Type Anchor Bolts: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 - e. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - f. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.
- H. General: Support all piping within 2 feet of change of direction on both sides of fitting.

END OF SECTION

VIBRATION AND SEISMIC CONTROLS

PART 1 GENERAL**1.01 DESCRIPTION**

- A. This section describes seismic restraints for piping, ductwork, conduit, tanks, and equipment, including clamps, rods, channels, struts, anchor bolts, nuts, and accessories.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 230529, Hangers and Supports
- B. Section 233113, HVAC Ductwork

1.03 REFERENCES

- A. AISC: American Institute of Steel Construction
 - 1. AISC Steel Construction Manual
- B. ASHRAE: American Society of Heating, Refrigerating and Air-Conditioning Engineers
- C. ASTM: American Society for Testing and Materials
 - 1. ASTM A36: Standard Specification for Carbon Structural Steel
- D. AWS: American Welding Society
 - 1. AWS D1.1: Structural Welding Code – Steel, 2010
- E. OSSC: Oregon Structural Specialty Code

1.04 GUIDELINES

- A. Seismic Restraint: Conform with the requirements of Section 230529, Hangers and Supports and additional requirements specified herein for seismic restraint of vibration isolated equipment, ductwork, and piping.
- B. Values for calculating seismic design forces shall be as described in Section 230529, Hangers and Supports.

1.05 SUBMITTALS

- A. Shop Drawings: Submit shop drawings showing complete details of construction for steel and concrete bases including:
 - 1. Equipment mounting holes.
 - 2. Dimensions.
 - 3. Isolation selected for each support point.
 - 4. Details of mounting brackets for isolator.
 - 5. Weight distribution for each isolator.
 - 6. Details of seismic snubbers.
 - 7. Code number assigned to each isolator.
- B. Product Data: Submit product data and calculation sheets for isolators, showing:
 - 1. Size, type, load and deflection of each required isolator.
 - 2. Percent of vibration transmitted based on the lowest disturbing frequency of the equipment.
- C. Installation Procedures: Submit procedures for setting and adjusting isolation devices.
- D. Package Equipment Calculations: Where buses, isolators and other equipment specified in this section are provided as part of packaged equipment, submit calculations certifying compliance with this section.
- E. Installation Report: Submit installation report as specified in Part 3 of this section.
- F. Structural Certifications: Submit calculations stamped and signed by a registered professional structural engineer licensed in the state of Oregon certifying mounting attachment points for isolators and seismic restraints will withstand forces calculated from values presented in Section 230529, Hangers and Supports.

VIBRATION AND SEISMIC CONTROLS

- G. Calculations: Seismic calculations indicating restraint loadings resulting from the design seismic forces presented in the Quality Assurance article of this section. Include proper anchorage details and when applicable shall include consideration of the types of concrete. Calculations shall be stamped and signed by a professional structural engineer licensed in the state of Oregon.
- H. Certifications: Certification of seismic restraint's and building structural member's capability to safely accept loads resulting from seismic forces calculated in the previous paragraph. Tests in three planes clearly showing ultimate strength and appropriate safety factors, performed by independent laboratories, stamped, and signed by a professional structural engineer licensed in the state of Oregon or calculations by a professional structural engineer licensed in the state of Oregon are acceptable.
- I. Shop drawings and calculations shall be stamped by a registered professional structural engineer licensed in the state of Oregon.

1.06 QUALITY ASSURANCE

- A. Except for packaged equipment with integral isolators, a single manufacturer shall select and furnish all isolation required.
- B. Isolation performance requirements shall be as indicated on the drawings. All deflections indicated shall be minimum actual static deflections for specific equipment supported.
- C. Isolator Stability:
 - 1. Size springs of sufficient diameter to maintain stability of the equipment being supported with minimum horizontal to vertical stiffness ratio not less than 1:1. Spring diameters shall be not less than 0.8 of the compressed height at rated load.
 - 2. Springs shall have a minimum additional travel to solid equal to 50 percent of the rated deflection.
- D. Maximum Allowable Vibration Levels: Peak vibration velocities shall not exceed 0.08 in/sec. If operating vibration velocities exceed this criteria, the equipment shall be repaired or replaced at no added expense to the Owner until approval of the equipment is given by the Owner's Representative.
- E. The seismic restraint and anchorage of permanent equipment and associated systems listed below to building structure shall be designed to resist the total design seismic force prescribed in the OSSC.
 - 1. Floor- or roof-mounted equipment.
 - 2. Suspended or wall-mounted equipment.
 - 3. Vibration-isolated equipment.
 - 4. Potentially hazardous or life-safety piping systems 1 inch or larger throughout the building.
 - 5. Ductwork 6 square feet and larger in cross sectional area.
 - 6. Round ductwork 28 inches in diameter and larger.
 - 7. Any piece of equipment that is not floor mounted with a weight greater than or equal to 25 pounds.
- F. Except for those which would individually require bracing, pipes, ducts, and conduit supported by a trapeze need not be braced if connections to the pipe/duct/conduit or directional changes do not restrict movement of the trapeze. If this flexibility is not provided, bracing shall be required when the combined operating weight of all elements supported by the trapeze is 10 pounds per foot or greater.

VIBRATION AND SEISMIC CONTROLS

- G. All seismic restraints, including anchors to building structure, shall be designed by a registered professional structural engineer licensed in the state of Oregon. Design shall include:
1. Number, size, capacity, and location of anchors for floor- or roof-mounted equipment. For curb-mounted equipment, provide design of attachment of both the unit to the curb and the curb to the structure. For units weighing greater than 2500 pounds, or curbs more than 10 feet long, provide calculations substantiating that the curb can accept the prescribed seismic forces.
 2. Number, size, capacity, and location of seismic restraint devices and anchors for vibration-isolation and suspended equipment. Provide calculations, test data, or California OSHPD approval number verifying the horizontal and vertical ratings of the seismic restraint devices.
 3. Number, size, capacity, and location of braces and anchors for suspended piping, ductwork, conduit, and cable trays on as-built plan drawings.
 - a. The Contractor shall select a single seismic restraint system pre-designed to meet the requirements of the OSSC such as the 1999 Mason Industries Seismic Restraint Guidelines for Suspended Piping, Ductwork and Electrical Systems.
 - b. Details or designs from separate seismic restraint guidelines are not acceptable. Installation not addressed by the selected system shall be designed, detailed, and submitted alone with the as-built plan drawings.
 - c. Maximum seismic loads shall be indicated on drawings at each brace location. Drawings shall bear the stamp and signature of the registered professional structural engineer licensed in the state of Oregon who designed the layout of the braces.
- H. Supports, Hangers, and Anchors: Comply with the requirements of Section 230529, Hangers and Supports.

PART 2 PRODUCTS**2.01 MATERIALS**

- A. Seismic Bracing: Steel fabrication, in accordance with AISC Steel Construction Manual, with structural steel shapes of ASTM A36 steel. Weld in accordance with AWS D1.1-10. Design and sizes shall be as required. Fastenings, bracing, and assembly shall be selected by a professional structural engineer licensed in the state of Oregon. Design calculations shall show that the maximum stress in any structural steel member will not exceed 18,000 psi.
- B. Channel type elements shall be No. 12 gauge formed steel; 1 5/8-inch square prime painted or chromate dip finish. Use spring-in nuts with grooves.
- C. Bolting accessories shall be machine bolts with semi-finished nuts.

2.02 TYPE 2 - RESTRAINED DOUBLE DEFLECTION NEOPRENE

- A. Restrained double deflection neoprene mountings with minimum actual static deflection of 0.35 inches for equipment supported.
- B. Friction pad both top and bottom.
- C. Steel rails used above those mountings of equipment with overhang.
- D. Manufacturers: Mason type RCA, CADDY, Vibration Mountings & Controls, Kinetics Noise Control, California Dynamics Corporation, or approved.

VIBRATION AND SEISMIC CONTROLS

2.03 SEISMIC RESTRAINTS

- A. Provide seismic restraints for all vibration isolated equipment, both supported and suspended, and all vibration isolated ductwork and piping. Refer to Section 230529, Hangers and Supports ; and Section 233113, HVAC Ductwork for additional and specific requirements. The structural requirements for the restraints, including their attachment to the equipment or piping and the building structure, shall meet the following provisions:
1. Supported Equipment:
 - a. The seismic restraints shall consist of interlocking steel members restrained by shock absorbent neoprene materials compounded to bridge bearing specifications. The elastomeric materials shall be replaceable and shall be a minimum 3/4-inch-thick. Snubbers shall be manufactured with an air gap between hard and resilient material of not less than 1/8 inch, nor more than 1/4 inch.
 - b. Each snubber shall be capable of restraint in all three mutually orthogonal directions.
 - c. Submittals shall include load versus deflection curves up to 1/2 inch on the x, y and z planes. Conduct tests in an independent laboratory or under the signed supervision of an independent registered engineer. The snubber assemblies shall be bolted to the test machine as the snubber is normally installed. Test reports shall certify that neither the neoprene elements nor the snubber body has sustained any obvious deformation after release of the load.
 2. Suspended Equipment, Ductwork, and Piping:
 - a. Cable Method: The seismic restraint shall consist of a combination of stranded steel aircraft cable and the specified vibration isolation hanger with an added nut and neoprene and steel washer. The cable resists lateral and downward motion. The modified vibration hanger resists upward motion.
 - b. Cable attachment details, cable size, and the neoprene and steel washers shall be sized by the manufacturer and shall be indicated in the shop drawings.
 - c. Provide detailed shop drawings for approval in sufficient time to allow structural attachment work to be incorporated into the normal work sequence.

PART 3 EXECUTION**3.01 GENERAL**

- A. Do not install any equipment, duct, or pipe which makes rigid contact with the building other than at points of support. "Building" includes slabs, beams, studs, walls, etc.
- B. The installation or use of vibration isolators shall not cause any change of position of equipment or piping which would result in stresses to piping connections or misalignment of shafts or bearings. In order to meet this objective, equipment and piping shall be maintained in a rigid position during installation. Do not transfer the load to the isolator until the installation is complete and under full operational load.

3.02 PREPARATION

- A. Treat all isolators, including springs, brackets, and housing, with a rustproof metal primer.
- B. Coat items exposed to weather with cadmium plating, galvanizing, or plastic coating.

3.03 INSTALLATION

- A. Equipment and tanks shall be braced or anchored to conform to the requirements listed under the Quality Assurance article of this section.
- B. Ductwork and piping shall be seismically braced to conform to the requirements listed under the Quality Assurance article of this section.
- C. Provide ductwork seismic flexible connectors where ductwork crosses building earthquake joints. Arrange ductwork and connectors for the amount of motion required.
- D. Powder-actuated inserts are not allowed.

VIBRATION AND SEISMIC CONTROLS

- E. Attach seismic restraints to structural members of the building which are capable of withstanding the design load of the seismic restraint. Ensure load capacity of the structural members is greater than or equal to the capacity of the seismic restraint.
- F. Seismic restraints shall not introduce stresses in piping caused by thermal expansion or contraction.

3.04 INSTALLATION

- A. General:
 - 1. Install isolation where indicated on the drawings by type and location and where indicated below. For all other equipment with rotating parts or motors, isolation and minimum static deflections shall comply with the ASHRAE Handbook, HVAC Applications, Sound and Vibration Control.
 - 2. Mark the assigned code number on the isolators and bases to assure placement in the proper location.
 - 3. Anchor baseplates to floor. Provide rubber grommets and washers to isolate the bolt from the base plate. Under no circumstances shall the isolation efficiency be destroyed when bolting the isolators to the floor.
- B. Isolation of Pipe and Ductwork:
 - 1. Install isolating hangers on all ductwork, and water piping connected to air handling units or other rotating equipment in mechanical rooms and within 40 feet of equipment. Provide isolating hanger supports for each piece of isolated equipment outside of mechanical rooms and where indicated. Isolators within 25 feet of equipment shall have a static deflection of 1 inch. Beyond 25 feet, isolators shall have a static deflection of 1/2 inch.
 - 2. Ductwork or piping supported from floor shall be isolated with Type 1 isolators.

3.05 SEISMIC RESTRAINTS (VIBRATION ISOLATED EQUIPMENT, DUCTWORK AND PIPING)

- A. General: Install and adjust seismic restraints so that the equipment and piping vibration isolation is not degraded by the restraints.
- B. Supported Equipment:
 - 1. Each vibration isolation frame for supported equipment shall have a minimum of four seismic snubbers mounted as close as possible to the vibration isolators and/or the frame extremities.
 - 2. Take care so that a minimum 1/8-inch air gap in the seismic restraint snubber is preserved on all sides so that the vibration isolation potential of the isolator is not compromised. This requires that the final snubber adjustment be completed after the vibration isolators are properly installed and the installation approved.

3.06 ELECTRICAL COORDINATION

- A. Make all electrical connections to isolated equipment using flexible electrical conduit. No conduit clamps or hangers shall be used between the flexible conduit and equipment. Provide non-stressed loop in conduit, unrestrained in all directions.

3.07 FIELD QUALITY CONTROL

- A. Confirm that all isolation is installed correctly and submit report stating that isolators are installed as shown on shop drawings, isolators are free to work properly, and that installed deflections are as scheduled and as specified.

END OF SECTION

MECHANICAL IDENTIFICATION

PART 1 GENERAL**1.01 DESCRIPTION**

- A. This section describes the identification of valves, piping, ductwork, and equipment components of the mechanical systems to indicate their function and system served.

1.02 REFERENCES

- A. ANSI: American National Standards Institute

1.03 SUBMITTALS

- A. Product Data: For all products specified herein.
- B. Valve Tag Directory: Submit for approval prior to fabrication of valve tags.
- C. Equipment Nameplate Directory: Submit for approval prior to fabrication of labels.
- D. Include copy of valve tag and equipment nameplate directories in each set of operation and maintenance manuals.

PART 2 PRODUCTS**2.01 VALVE IDENTIFICATION**

- A. Valve Tags:
 - 1. General: Identify valves with metal tags. Legends shall be stamped or embossed. Tags shall indicate the function of the valve and its normal operating position.
 - 2. Size: Valve tags 2-inch diameter with 1/4-inch-high letters.
 - 3. Material: Use 0.050 or 0.064-inch brass tags.
 - 4. Automatic Valves and Regulating Valves: Use 1/16-inch-thick laminated 3-ply plastic, center ply white, outer ply black. Form letters by exposing center ply.
 - 5. Existing Buildings and Systems: Contact the Owner's Representative for coordination with existing building tagging system and supplementary information required for any specific system before valve tagging begins.
- B. Valve Tag Directory: Include tag number, location, exposed or concealed, service, valve size, valve manufacturer, valve model number, tag material, and normal operating position of valve.

2.02 PIPING MARKERS

- A. Acceptable Manufacturers: W. H. Brady, Seton, Marking Systems, Inc. (MSI), or Approved.
- B. Label pipes with all-vinyl, self-sticking labels or letters. For pipe covering sizes up to and including 3/4-inch outside diameter, select labels with 1/2-inch letters. For sizes from 3/4- to 2-inch outside diameter, 3/4-inch letters; above 2 inches outside diameter, 2-inch letters. The pipe markers shall be identified and color coded in compliance with ANSI 13.1-2015 Standard.

2.03 EQUIPMENT IDENTIFICATION

- A. Nameplates:
 - 1. Tag all fans and miscellaneous items of mechanical equipment with engraved nameplates. Nameplates shall be 1/16-inch-thick, 3 x 5 laminated 3-ply plastic, center ply white, outer ply black. Form letters by exposing center ply.
 - 2. Identify unit with code number as shown on drawings and area served.
- B. Equipment Nameplate Directory: List equipment nameplates. Include Owner- and Contractor-furnished equipment. List nameplate designation, manufacturer's model number, location of equipment, area served or function, disconnect location, and normal position of HOA switch.
- C. Thermostat, Sensor and T-bar labels:
 - 1. Tag all thermostats and sensors of mechanical equipment with engraved nameplates. Nameplates shall be 1/16-inch-thick, minimum 1" x 2" laminated 3-ply plastic, center ply white, outer ply black. Form letters by exposing center ply.

MECHANICAL IDENTIFICATION

2. Identify unit with code number as shown on drawings.
- D. Control equipment:
 1. Tag all control equipment and accessories with engraved nameplates. Nameplates shall be 1/16-inch-thick, minimum 1" x 2" laminated 3-ply plastic, center ply white, outer ply black. Form letters by exposing center ply.
 - a. Minimum letter size shall be the following:
 - 1) 0.25-inches: Electrical Power Devices, Accessories, Instruments, Control dampers, and valve actuators.
 2. Tag shall be fastened with drive pins.

PART 3 EXECUTION

3.01 VALVE IDENTIFICATION

- A. Valve Tags:
 1. Attach to valve with a brass chain.
 2. Number valves per direction of the Owner's Representative.
- B. Valve Tag Directory: Post final copy in operation and maintenance manual.

3.02 PIPING MARKERS

- A. Unless recommendations of ANSI A13.1 are more stringent, apply labels or letters after completion of pipe cleaning, insulation, painting, or other similar work, as follows:
 1. Every 20 feet along continuous exposed lines.
 2. Every 10 feet along continuous lines in mechanical rooms and other areas of congested piping and equipment.
 3. Adjacent to each valve and stubout for future.
 4. Where pipe passes through a wall, into and out of concealed spaces.
 5. On each riser.
 6. On each leg of a "T."
 7. At access doors, manholes and similar access points that permit view of concealed piping.
 8. Locate conspicuously where visible.
- B. Further, apply labels or letters to lower quarters of the pipe on horizontal runs where view is not obstructed or on the upper quarters when pipe is normally viewed from above. Apply arrow labels indicating direction of flow.
- C. Spray a protective coating of clear epoxy over markers and arrows in corrosive atmosphere areas.

3.03 EQUIPMENT IDENTIFICATION

- A. Nameplates: Attach to prominent area of equipment, either with sheet metal screws, brass chain, or contact cement as applicable.
- B. Nameplate Directory: Post final copy in operation and maintenance manual.

3.04 THERMOSTATS AND SENSORS

- A. Label each thermostat/sensor with associated unit identifier on inside of cover as shown on the drawings. Use sensor labels and attach with contact cement.

END OF SECTION

TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL**1.01 DESCRIPTION**

- A. This section describes adjustment, testing, and balancing of air systems, and miscellaneous mechanical equipment.

1.02 REFERENCES

- A. AABC: Associated Air Balance Council
- B. NEBB: National Environmental Balancing Bureau

1.03 SUBMITTALS

- A. Submit the following:
 - 1. Balancing Log: Include all air and water outlets, actual field-measured air volume and percentage of design volumes. Provide drawings identifying locations of all outlets.
 - 2. Equipment Data Sheets: Indicate actual equipment performance, model numbers, bearing and belt data, motor nameplate data, and final balanced motor data.
 - 3. Additional Data: Submit all additional data as provided by AABC or NEBB Standard forms.
 - 4. Instrument Certification: When requested, submit certificate of calibration for all equipment to be used.
 - 5. Adjustment and Balancing Plan and Schedule.

1.04 QUALITY ASSURANCE

- A. Acceptable Testing, Adjustment, and Balancing Firms:
 - 1. Air Balancing Specialty, Inc.
 - 2. Neudorfer Engineers, Inc.
 - 3. Northwest Engineering, Inc.
 - 4. Or Approved.
- B. Industry Standards: Testing, adjustment, and balancing shall be conducted in a manner recognized by the AABC or NEBB and recorded on forms similar to those published by the AABC or NEBB.
- C. Instrument Certification: All instruments used shall be accurately calibrated and certified within six months of balancing and maintained in good working order.
- D. Test Observation: If requested, conduct tests in the presence of the Owner's Representative.
- E. Pre-Balancing Conference: TAB contractor shall schedule and hold conference with Owner's Representatives to review balancing plan prior to starting work.

1.05 PROJECT CONDITIONS

- A. Perform balancing on existing systems prior to any system revisions being made.
- B. Do not perform testing, adjusting, and balancing work until heating, ventilating, and air conditioning equipment has been completely installed, operational testing of control system is complete.
- C. Conduct testing and balancing with clean filters in place. Simulate dirty filter loading for electrical equipment room economizer fans.

PART 2 PRODUCTS (NOT USED)**PART 3 EXECUTION****3.01 AIR SYSTEMS**

- A. General: Measurements shall be in accordance with recognized procedures and practices of the AABC or NEBB. Record on appropriate forms.

TESTING, ADJUSTING, AND BALANCING

- B. Preliminary:
 - 1. Identify and list size, type, and manufacture of all equipment to be tested, including air outlets and inlets.
 - 2. Use manufacturer's ratings for equipment to make required calculations except where field test shows ratings to be impractical.
- C. Execution:
 - 1. Adjust fan speeds and motor drives for required air volume, within +5 percent maximum. Set speed to provide air volume at farthest run without excess static pressure. Provide additional sheaves and belts as required to accomplish speed adjustment.
 - 2. Read and adjust air supply, return, and exhaust fan units to deliver design conditions at minimum O.S.A. and at 100 percent O.S.A.
 - 3. Adjust all automatic dampers, outside air, return air, and exhaust dampers for design conditions.
 - 4. Read static air pressure conditions on all air handling equipment, including filter and coil pressure drops, and total pressure across the fan. Use a Dwyer Series 400 air velocity meter, or equivalent, for final static pressures at equipment and where critical readings are required.
 - 5. Measure temperature conditions across all outside air, return air, and exhaust dampers to check leakage.
 - 6. Read and record motor data and amperage draw.
 - 7. For variable volume systems, establish minimum static pressure required at sensing point to permit operation over entire VAV range.
- D. Distribution:
 - 1. Read and adjust all air outlets to design air volumes, within 10 percent of design. Advise the Owner's Representative if deficiencies are noted to enable proper corrective actions.
 - 2. Evaluate all building and room pressure conditions to determine adequate supply and return air conditions.
 - 3. Evaluate all building and room pressure conditions to determine adequate performance of the system to maintain temperatures without draft.
 - 4. Perform multipoint pitot traverses to confirm instrumentation, shaft tightness, fan operation, etc. Pitot traverses shall be performed using a Dwyer Series 400 air velocity meter, or equivalent, only with applicable duct probe.
 - 5. Mark all balancing dampers.

3.02 AUTOMATIC CONTROL SYSTEM

- A. In cooperation with mechanical contractor, set and adjust automatically operated devices to achieve required sequence of operations.

3.03 COORDINATION

- A. Coordinate work between balancing agency and other trades to ensure rapid completion of the work.
- B. Engage the balancing agency to assist with:
 - 1. Checkout, startup, calibration of instrumentation, and operational, functional, and final acceptance test plans, procedures, checklists and reports.
 - 2. Development of systems manuals.
 - 3. Development of operation and maintenance manuals and training plan.
- C. Deficiencies noted during the course of air balancing in the mechanical installation shall be promptly reported to the Architect to allow corrective action to proceed.
- D. Provide periodic review of progress as requested.

END OF SECTION

MECHANICAL INSULATION

PART 1 GENERAL

1.01 DESCRIPTION

- A. This section describes insulation for piping, ductwork, and equipment.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 230050, Basic Mechanical Requirements
- B. Section 230529, Hangers and Supports

1.03 REFERENCES

- A. ASHRAE: American Society of Heating, Refrigeration, and Air-Conditioning Engineers
- B. ASTM: American Society for Testing and Materials
- C. NFPA: National Fire Protection Association
- D. UL: Underwriters Laboratories

1.04 SUBMITTALS

- A. Product Data: For each type of insulation, including density, conductivity, thickness, jacket, vapor barrier and flame spread and smoke developed indexes.

1.05 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Flame and Smoke Ratings: Installed composite flame spread not to exceed 25 and smoke developed not to exceed 50 as tested by UL 723 and ASTM E84.
 - 2. Energy Codes: ASHRAE 90.1-2019 shall govern where requirements for thickness exceeds thickness specified.
- B. Protection: Protect against dirt, water, chemical or mechanical damage before, during, and after installation. Repair or replace damaged insulation at no additional cost to the Owner.
- C. Source Quality Control:
 - 1. Service: Use insulation specifically manufactured for service specified.
 - 2. Labeling: Insulation labeled or stamped with brand name and number.
 - 3. Insulation and accessories shall not provide any nutritional or bodily use to fungi, bacteria, insects, rats, mice or other vermin, shall not react corrosively with equipment, piping or ductwork and shall be asbestos free.

PART 2 PRODUCTS

2.01 GENERAL

- A. Each insulation type shall be of one manufacturer.
 - 1. Fiberglass insulation manufacturers:
 - a. CertainTeed
 - b. Knauf Insulation
 - c. Johns Manville
 - d. Owens Corning
 - e. Or Approved.

2.02 DUCT INSULATION, EXTERNAL

- A. Fiberglass: blanket 2-inch thick unless specified or shown otherwise with 1.0 psf nominal density, 0.27 per inch maximum K-factor at 75°F mean temperature, 250°F minimum service rating and foil-scrim-kraft jacket. Insulation shall meet ASTM C553, NFPA 90A.
- B. Semi-Rigid Fiberglass: 1 1/2-inch thick unless specified or shown otherwise with 3.0 pcf density, 0.23 per inch maximum K-factor at 75°F mean temperature, 150°F minimum service rating and all purpose vapor barrier facing with white Kraft paper finish. Insulation shall meet ASTM C612, NFPA 90A.

MECHANICAL INSULATION

- C. Rigid Fiberglass: Same as semi-rigid except with 6.0 pcf density and 0.22 per inch maximum K-factor.

2.03 DUCT INSULATION, INTERNAL

- A. Description: 1-1/2-inch-thick fiberglass unless specified or shown otherwise, mat-faced or dual density acoustical blanket with 1.5 pcf density, 0.28 per inch K-factor at 75°F mean temperature and 250°F minimum service rating rated for velocities up to 4,000 FPM.
- B. Acoustical Absorption Coefficients: With minimum NRC of 0.65 for 1-inch and 0.85 for 2 inch as tested in accordance with ASTM C423.
- C. Liner shall meet ASTM C1071, ASTM C1338, ASTM G21 and NFPA 90A.

2.04 ACCESSORIES

- A. Adhesives:
1. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
 2. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 3. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
- B. Pins, anchors: Welded pins, or metal or nylon anchors with galvanized steel or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.
- C. Mineral-Fiber Insulating Cements: Comply with ASTM C 195.
- D. Expanded or Exfoliated Vermiculite Insulating Cements: Comply with ASTM C 196.
- E. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
- F. Staples: Outward clinching galvanized steel.
- G. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd. 4-inches wide.
- H. Bands: 3/4 inch wide, Stainless Steel, ASTM A 666, Type 304; 0.020 inch thick.
- I. Wire: 0.062-inch, soft-annealed, stainless steel.
- J. Mastic: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates. Comply with MIL-C-19565C, Type II.

PART 3 EXECUTION**3.01 GENERAL**

- A. Applicators: Applicators shall be employed by a firm that specializes in insulation work.
- B. Preparation: Surfaces of piping, equipment, and ductwork shall be clean, free of oil or dirt, and dry before insulation is applied.
- C. Stamps: ASME stamps, UL labels, and similar stamps and labels shall not be covered.
- D. Any insulation that becomes damaged, water soaked, or stained shall be replaced at no additional cost to the Owner.

3.02 INSULATION APPLIED LOCATIONS

- A. General:
1. All external insulation shall have continuous vapor barriers unless specifically noted otherwise.
 2. Internally lined ductwork shall be lined completely to grille or diffuser or to indicated terminal points.
 3. Internally lined ductwork that does not meet energy code requirements shall be insulated.

MECHANICAL INSULATION

- B. Supply and Return Ductwork:
1. Exposed: Rectangular ductwork insulated with rigid fiberglass board. Round ductwork insulated with semi-rigid fiberglass board.
 2. Concealed: Insulated with fiberglass blanket.
 3. Internally lined: insulated with fiberglass liner.

3.03 DUCTWORK INSTALLATION

- A. General:
1. Install in accordance with the manufacturer's instructions.
 2. The vapor barrier shall be continuous. Tears, holes, staples, etc. shall be coated with vapor barrier mastic and patched with facing or tape. Joints between insulation and access shall be provided with vapor barrier mastic.
 3. Insulation at access panels shall be removable or attached to panel with edges of panel and opening reinforced with metal beading.
- B. External Blanket Insulation:
1. Secure insulation to ductwork with 20-gauge snap wires 24 inches on center and at all joints.
 2. Lap joints and seams a minimum of 3 inches and sealed with jacket tape.
- C. Board Insulation:
1. Space rectangular ducts with weld pins a maximum of 18 inches on center in both directions.
 2. All corners shall be made with joints; bending insulation around corners will not be allowed.
 3. All joints and seams shall be butted tight together.
 4. Butt joints with 3-inch-wide tape.
 5. Finish corners with 3-inch-wide tape.
- D. Internal Duct Liner:
1. The coated surface shall face air stream.
 2. Weld pins spaced maximum of 15 inches on center in both directions and within 2 inches of all corners and joints. Weld pins flush with liner surface.
 3. Complete duct surface coated with adhesive and insulation pressed tightly thereto.
 4. Edges at terminal points shall be provided with metal beading and heavily coated with adhesive.
 5. All joints and corners shall be heavily coated with adhesive.
- E. Volume Dampers: Where volume dampers do not allow for continuous insulation, terminate insulation clear of handle sweep and finish edges to maintain vapor barrier and to prevent damage to the insulation.

3.04 FIELD QUALITY CONTROL

- A. Field Test: All systems shall be tested and approved prior to installation of insulation.
- B. Existing Insulation:
1. Repair existing insulation damaged during construction.
 2. Make neat connections where new and existing insulation meet.
 3. Where existing piping, ductwork, or equipment is removed, cover existing surfaces neatly to match existing.

END OF SECTION

HVAC DUCTWORK

PART 1 GENERAL

1.01 DESCRIPTION

- A. This section describes ductwork, and exposed ductwork for typical building HVAC applications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 230050, Basic Mechanical Materials and Methods
- B. Section 230529, Hangers and Supports
- C. Section 230548, Vibration and Seismic Controls
- D. Section 230553, Mechanical Identification
- E. Section 230713, Mechanical Insulation
- F. Section 233300, Duct Accessories
- G. Section 233713, Diffusers, Registers and Grilles
- H. Section 230593, Testing, Adjusting, and Balancing

1.03 REFERENCES

- A. NFPA: National Fire Protection Association
- B. OMSC: Oregon Mechanical Specialty Code
- C. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association
- D. UL: Underwriters Laboratories

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Work performed by qualified, experienced mechanics, in accordance with the SMACNA HVAC Duct Construction Standards and these specifications.
- B. Regulatory Requirements:
 - 1. Flame and Smoke Ratings: Installed composite flame spread not to exceed 25 and smoke developed not to exceed 50 as tested by UL 723.
 - 2. Sheet Metal Ductwork, Flexible Ducts, and Exposed Ductwork:
 - a. Entire ductwork system, including materials and installation, shall be installed in accordance with NFPA 90A.
 - b. Ductwork and components shall be listed as UL 181, Class I air duct; flame rating shall not exceed 25 and smoke rating shall not exceed 50.

PART 2 PRODUCTS

2.01 HANGERS, SUPPORTS, ANCHORAGE, SEISMIC RESTRAINTS, AND SEISMIC CONTROL

- A. Provide hangers, supports, anchorage, seismic restraints, and seismic control for products specified herein in accordance with the requirements of the contract documents and SMACNA "HVAC Duct Construction Standards."

2.02 SHEET METAL DUCTWORK

- A. Fabricate from galvanized steel, unless noted otherwise on the drawings.
- B. Minimum gauge, duct construction, joint reinforcing, and fittings shall be in accordance with SMACNA "HVAC Duct Construction Standards - Metal and Flexible."
- C. Duct Classification: Ducts shall be considered low pressure when design velocities are 2000 fpm or less and maximum static pressure is 2-inch W.G., positive or negative.
 - 1. Construct the ductwork in accordance with minimum reinforcement requirements for static pressure class of 2-inch W.G. positive or negative.

HVAC DUCTWORK

- D. Longitudinal seams on rectangular duct shall be Pittsburgh or Button punch snap lock, or equivalent. Snap lock seams for round duct may be used only on ducts classified for 1/2-inch W.G. Longitudinal seams for round ducts using lap and rivet, spot weld, or fillet weld may be used only on ducts classified for statics 1-inch W.G. or less.
- E. For rectangular ductwork joining and reinforcing systems shall be either shop fabricated to SMANCA requirements or manufactured by Ductmate. Ductmate 35 is equivalent to SMACNA "J," and Ductmate 25 is equivalent to SMACNA "F."
- F. For spiral round ductwork, lateral joints shall have center beaded slip collars. Crimped joints are prohibited.
- G. Do not use adjustable round elbows.
- H. Fittings:
 - 1. Transitions of concentric type or eccentric type to maintain elevations detailed, with not more than 30-degree angle variation on sloped portion.
 - 2. Round elbows: 5-piece radius elbows with 1.5 radius to diameter ratio. Stamped elbows prohibited.
 - 3. Rectangular elbows: Mitered elbows with turning vanes or radius elbows with 1.5 radius to diameter ratio.
 - 4. Rectangular branches: 45-degree Entry
 - 5. Round mains to round branches: 45-degree lateral fitting. Saddle taps prohibited.

2.03 EXPOSED DUCTWORK IN FINISHED SPACES

- A. Round:
 - 1. Material: Round or flat oval, machine formed, spiral lock-seam galvanized sheet metal ductwork of thicknesses as listed for sheet metal duct.
 - 2. Fittings: Machine formed, shop fabricated, with welded seams, designed for easiest air flow.
 - 3. Reducing Fittings: May be used unless noted otherwise.
- B. Rectangular: Same as for sheet metal ductwork. All reinforcing shall be inside. Use special care to prevent imperfections in the metal surface.

PART 3 EXECUTION

3.01 APPLICATIONS

- A. HVAC Supply Air Ductwork: Galvanized Sheet metal, lined where indicated on drawings. Refer to Section 230713, Mechanical Insulation.
- B. General Exhaust Ductwork: Sheet metal.
- C. Exposed HVAC Ductwork in Finished Spaces: Galvanized Sheet metal, lined where indicated on drawings.

3.02 INSTALLATION

- A. Sheet Metal Ductwork:
 - 1. Seal all joints and seams with an approved mastic during joining procedure or tape after joining to provide airtight duct system. Ductwork to meet SMACNA Seal Class A requirements. Ductwork subject to pressure testing shall have a SMACNA Leakage Class rating of 6 or less.
 - a. Exposed ductwork: Sealant to match color of ductwork. Sealant edges shall be straight with no irregularities or feathering.
 - 2. Hang, support, restrain, and control movement and vibration of low pressure ductwork systems, equipment, and components in accordance with the requirements of the contract documents and SMACNA "HVAC Duct Construction Standards - Metal and Flexible." Do not use wire supports.

HVAC DUCTWORK

3. Provide supplementary steel for support of ductwork in shafts and between building structural members.
 4. Fabricate changes in direction to permit easy air flow, using full 1.5D radius bends. Use of square throat radius elbows in rectangular ductwork is acceptable.
 5. Change in duct size or shape necessitated by interference shall be made using rectangular equivalents of equal velocity.
 6. Where pipe, structural member, or other obstruction passes through a duct, provide streamlined sheet metal collar around member and increase duct size to maintain net free area. Fit collar and caulk to make airtight.
- B. Dampers: Install where shown and where required. Install regulators as specified. Leave all dampers locked wide open.
- C. Flexible Connectors: Make connections to fans and other rotating equipment with flexible connectors with 2-inch minimum clearance between casing and ductwork.
- D. Ductwork, Exposed in Finished Areas:
1. Use extreme care in handling and installing.
 2. Replace all dented or damaged sections.
 3. Install ductwork straight and true, parallel to building lines.
 4. Make all connections with pop rivets using couplings where applicable. Grind all raw edges smooth and apply sealant.
 5. Remove all excess sealant to provide a finished joint.
 6. Provide floor, wall, and ceiling plates.
 7. Finish and clean all ductwork and hangers.

3.03 TESTING

- A. Check out, start up, and test systems, equipment, and components specified herein.
- B. Coordination with Balancing Agency:
1. Provide the services of a sheet metal firm familiar with the system ductwork to assist the balancing agency during the initial phases of air balancing in locating all sheet metal dampers.
 2. Install missing dampers.

END OF SECTION

DUCT ACCESSORIES

PART 1 GENERAL**1.01 DESCRIPTION**

- A. This section describes HVAC duct accessories, sealants, flexible connectors, and access doors.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 230713, Mechanical Insulation
- B. Section 233113, HVAC Ductwork

1.03 REFERENCES

- A. NFPA: National Fire Protection Association
- B. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association, Inc.

1.04 SUBMITTALS

- A. For systems, equipment, and components specified herein, submit product/material data; shop drawings; operation and maintenance data; as-constructed data; installation, startup, and testing manuals; operation and maintenance manuals; and as-constructed drawings.
 - 1. Include the manufacturer's installation instructions.

1.05 QUALITY ASSURANCE

- A. Work shall be performed by qualified, experienced mechanics in accordance with SMACNA and these specifications.
- B. Install entire ductwork system, including materials and installation, in accordance with NFPA 90A.
- C. Flexible connectors, flexible equipment connections, tapes and sealants shall be listed as UL 181, Class I air duct; flame spread rating shall not exceed 25 and smoke developed rating shall not exceed 50.

PART 2 PRODUCTS**2.01 HVAC DUCT ACCESSORIES**

- A. Bell Mouth Fittings: Round or flat oval, radius of 0.20 D minimum.
- B. Flexible Equipment Connections: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 24-gauge, galvanized sheet steel. Fabric strip shall be glass fabric coated in neoprene.
- C. Turning Vane Assemblies:
 - 1. Sheet Metal Vanes: Multiple radius hollow vane air foil type 2-inch (small vane) or 4 1/2-inch (large vane) inside radius, galvanized steel construction.
 - 2. Runners: Push-on type.
- D. Access Doors:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following: Elgen, Greenheck, Nailor, or equivalent.
 - 2. Doors shall be complete with steel frame, steel door with backing plate, cam latches (two on units 14-inch by 14-inch and larger), hinge and gasketing. Doors on insulated or lined ducts shall be insulated.

DUCT ACCESSORIES

3. Size:

<u>Duct Width or Duct Diameter</u>	<u>Net Access Door Opening</u>
Up to 8"	6" x 6"
9" to 12"	8" x 8"
13" to 20"	12" x 12"
21" to 30"	16" x 14"
31" to 42"	18" x 14"
Over 42"	Two 16" x 14"

- E. Balancing dampers to be factory fabricated with 20-gauge galvanized steel frame and blades, 0.5-inch plated steel axle and synthetic bearings, along with external manual quadrant actuator.
 - 1. Single blade dampers shall be reinforced or crimped for rigidity, with jackshaft extending through duct. Dampers over 12 inches high shall use multiple opposed blade damper. Single blade damper shall be no larger than 12 inches by 48 inches with a maximum 6-inch distance from shaft to edge of blade.
 - 2. Butterfly dampers shall be fabricated of 18-gauge galvanized steel.
 - 3. Dampers shall be of length suitable to close branch ducts without damper flutter.
 - 4. Damper blade shall be aligned with handle and index pointer.
- F. Sealants: Comply with UL-181M along with SMACNA pressure and sealing classes. Mold, mildew and water resistant. Shall be low VOC emitting and for indoor applications shall be water-based.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install all devices in accordance with the manufacturer's recommendations.
- B. Install duct accessories in accordance with Section 233113, HVAC Ductwork.
- C. Access Doors: Install where indicated and at all automatic control dampers, fire dampers, and air flow stations to provide access for cleaning and maintenance.

3.02 TESTING

- A. Check out, start up, and test systems, equipment, and components specified herein.

END OF SECTION

DIFFUSERS, REGISTERS AND GRILLES

PART 1 - GENERAL**1.01 SUMMARY**

- A. Related Requirements:
 - 1. Section 233300 "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 PRODUCTS**2.01 MANUFACTURED DIFFUSERS, REGISTERS, AND GRILLES**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Price Company
 - 2. Greenheck
 - 3. Carnes Co. Inc.
 - 4. Or Approved.

2.02 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Examine areas where diffusers are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.
- C. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 GENERAL**1.01 DESCRIPTION**

- A. This section describes split-system air-conditioning units consisting of separate evaporator-fan and compressor-condenser components.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 230050, Basic Mechanical Materials and Methods
- B. Section 230529, Hangers and Supports
- C. Section 230548, Mechanical Vibration and Seismic Controls
- D. Section 230553, Mechanical Identification
- E. Section 230593, Testing, Adjusting, and Balancing
- F. Section 230993, Sequence of Operations
- G. Section 232113, HVAC Piping

1.03 REFERENCES

- A. NEC: National Electrical Code

1.04 QUALITY ASSURANCE

- A. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL) and shall bear the ETL label.
- B. The units shall be rated in accordance with Air-conditioning, Heating, and Refrigeration Institute's (AHRI) Standard 210/240 and bear the ARI Certification label.

1.05 SUBMITTALS

- A. For systems, equipment, and components specified herein, submit product/material data; shop drawings; operation and maintenance data; as-constructed data; installation, startup, and testing manuals; operation and maintenance manuals; and as-constructed drawings.
 - 1. Shop Drawings: Include dimensions and details of construction.
 - 2. Product Data: Show performance data, standard items and accessories, and operating weight.

PART 2 PRODUCTS**2.01 SPLIT-SYSTEM AIR-COOLED CONDENSING UNIT AND FAN-COIL UNITS (5-TONS AND LESS)**

- A. Acceptable Manufacturers:
 - 1. Samsung
 - 2. LG
 - 3. Mitsubishi
 - 4. Daikin
 - 5. or Approved.
- B. Air-Cooled Condensing Unit:
 - 1. Description: Provide air-cooled condensing units designed for outdoor installation with factory supplied supports, properly assembled and tested at the factory. Unit shall be completely weatherproofed and include compressor, condenser coils, condensing fans, motor, refrigerant reservoir, charging valve, controls, and a holding charge of R410A. Provide guards on condenser fans and coil guard.
 - 2. Unit shall be capable of cooling operation down to ambient temperature of 0°F without additional low ambient controls.

SPLIT-SYSTEM AIR-CONDITIONERS

3. Compressors: Furnish hermetically sealed or twin-rotor rotary type with isolation and sound muffling. Units shall have overload and inherent winding thermostat protection to prevent burnout.
 4. Condenser Coil: Non-ferrous construction consisting of aluminum plate fins mechanically bonded to seamless copper tubes and circuited for subcooling. Condenser coil shall have coil protection screens on to prevent coil damage.
 5. Condenser Fans and Motors: Direct-driven propeller type fans with permanently lubricated motors.
 6. Hot gas bypass for capacity control is prohibited.
 7. Controls: Provide high and low pressure cutouts, contactors and internal overload protection on all motors. Provide low ambient operation to 50°F outside to maintain condensing temperature on part load operation. Provide short cycle timer.
 8. Supports: Provide structural steel support. Submit for review before fabrication
- C. Wall Mounted Fan-Coil unit:
1. Indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.
 2. Provide field installed backing plate for unit installation on wall.
 3. Fan and Motor: Centrifugal type, direct-drive, permanently lubricated motor.
 4. Filters: Manufacturer's standard washable filter.
 5. Cooling Coil: Non-ferrous construction with aluminum fins mechanically bonded to seamless copper tubing with all joints brazed.
 6. Drain Pan: Drain pan with drain connection. Pan shall extend under coil for proper drainage of condensate.
- D. Controls:
1. Provide thermostat assembly with staged cooling, cooling setpoint and fan control.
 2. Include complete packaged unit-mounted controls and all required safety controls.
 3. Comply with Energy code dead-band, setback and optimum start requirements.
- E. Accessories:
1. Provide with condensate drain pump. Pump manufacturer to be compatible with fan coil unit manufacturer.
 2. Provide pre-insulated refrigerant line sets for connecting indoor and outdoor units.

PART 3 EXECUTION**3.01 GENERAL SPLIT-SYSTEMS INSTALLATIONS**

- A. Installation:
1. Install and level unit and secure to structure.
 2. For on-grade equipment installation, provide concrete housekeeping pad for installation. Housekeeping pad to be minimum 6-inches beyond equipment footprint.
 3. Make piping connections. Provide minimum 2-inch trap seal on all condensation drain connections.
 4. Provide interconnecting wiring from evaporator, condenser, and control panel. Provide interconnecting piping between fan-coil unit and condensing unit. Size and run refrigerant piping between condensing unit and fan-coil unit in accordance with the manufacturer's instructions. Provide double discharge risers recommended by the manufacturer.
- B. Controls:
1. Elevator Machine Room:
 - a. Fan coil units to operate continuously during call for cooling or heating.
 - b. Cycle mechanical cooling as required to maintain 78-degrees F.

SPLIT-SYSTEM AIR-CONDITIONERS

- c. Cycle mechanical heating as required to maintain 55-degrees F.

3.02 TESTING

- A. Check out, start up, and test systems, equipment, and components specified herein.
- B. Factory trained and authorized personnel are required to perform the following startup services.
 - 1. Comply with the manufacturer's instructions.
 - 2. Install filters before operating unit.
 - 3. Ensure proper water and air flow before operating unit compressor.
- C. Testing and Adjusting/Performance Test: Except where initial unit operation clearly shows the performance meets or exceeds the requirements, test to show compliance. Tests shall be performed by the manufacturer's representative in the presence of the Owner's Representative.

END OF SECTION

BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes general requirements for electrical installations.

1.02 SUBMITTALS

- A. Submit for approval, submittal documents as required in each Specification Section.
1. Submit all shop drawings and product data grouped to include submittals of relate systems, products, and accessories in a single electronic submittal in PDF format.
 2. Each submittal shall be indexed according to Specification Section.
 3. Each Specification Section shall be a separate file.
 4. Create PDFs at native size and right-side up; illegible files and secured files will be rejected.
 5. Mark dimensions and values in units to match those specified.
- B. No apparatus or equipment shall be shipped or fabricated until submittal documents for same have been reviewed and returned, "no exceptions taken" or "make corrections noted".
- C. Products List: Include the following:
1. Manufacturer's name and address.
 2. Catalog designation or model number.
 3. Equipment schedule number (cross referenced from drawings).
 4. Rough-in data and dimensions.
 5. Detailed drawings, including manufacturers catalog numbers showing all components.

1.03 DEFINITIONS

- A. Provide: Except to the extent further defined, the term "provide" means to furnish and install, complete and ready for the intended use.
- B. Specification Language: Imperative language is used, generally, throughout the Specifications. Requirements expressed imperatively are to be performed by the Contractor. For clarity at certain locations, contrasting subjective language is used to describe responsibilities which must be performed by the Contractor or, when so noted, will be performed by others.
- C. Equipment Specified and Specified Equipment: Equipment that is identified in schedules, specifications, and drawing notes.
- D. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
- E. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and electrical equipment rooms.
- F. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

1.04 RECORD DOCUMENTS

- A. Prepare record documents to indicate the following installed conditions:
1. Equipment locations (exposed and concealed), dimensioned from prominent structural building lines.
 2. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

1.05 SPECIFICATIONS COMPLIANCE

- A. The requirements of these specifications shall be complied with in every respect. Therefore, it shall be absolutely mandatory the job foreman, as well as the subcontractors and their foremen have completely studied the Drawings and these specifications (The Contract Documents), be completely knowledgeable as to their entire contents, and maintain a copy at the jobsite. Every foreman shall be provided with a complete copy of this specification.

BASIC ELECTRICAL REQUIREMENTS

1.06 CONTRACT DOCUMENTS

- A. Contract Documents for Work are in part diagrammatic, intended to convey the scope of Work and indicate general arrangement of equipment, wiring, and approximate locations of equipment connections, lighting, and outlets. Do not scale the Contract Documents for measurements.
- B. Outlets or equipment shown on the Drawings with no indication shall be completed in the same method and manner as similar outlets or equipment shown on the Drawings.
- C. The Contractor shall follow the Contract Documents in laying out the work, to become familiar with all conditions affecting the work and shall verify all spaces in which the work will be installed.
- D. Where job conditions require reasonable changes in indicated locations or arrangements, make changes without additional cost to the Owner.
- E. The Contract Documents and Specifications are to be cooperative and whatever is called for by either shall be binding as if called for by both.

1.07 USE OF EQUIPMENT

- A. The use of any equipment or any part thereof, for purposes other than testing, even with the Owner's consent, shall not be construed to be an acceptance of the work on the part of the Owner, nor shall it be construed to obligate the Owner in any way to accept improper work or defective materials.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.01 DAMAGE TO OTHER WORK

- A. The Contractor shall be responsible for damage done to existing equipment, structures, systems, etc., which damage is a direct or indirect result of this work. Such damage will be repaired at the expense of the Contractor to the full satisfaction of the Owner.

3.02 OPERATING INSTRUCTIONS

- A. Instruct the Owner's personnel in the care, operation and maintenance of all apparatus and equipment.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

END OF SECTION

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. General electrical installation requirements.
 - 2. Cutting and Patching.
 - 3. Cleaning requirements.

1.02 QUALITY ASSURANCE

- A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.01 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment level and plumb, parallel, and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- B. Install electrical equipment to facilitate service, maintenance, and repair or replacement of components.

3.02 COOPERATION WITH OTHER TRADES

- A. The Contractor shall cooperate with other trades to avoid interferences in the work and to avoid delays in the construction.
- B. Interference, which occurs as a result of poor coordination or lack of cooperation, shall be corrected at the Contractor's expense.

3.03 ROUGH-IN

- A. Verify final locations for rough-in with field measurements and with the requirements of the actual equipment to be connected.

3.04 CUTTING AND PATCHING

- A. Perform cutting and patching as follow:
 - 1. During cutting and patching operations, protect adjacent installations.
 - 2. Patch all holes, gaps, penetrations, and the like left by removal of Electrical systems, equipment, and components indicated.
- B. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- C. Patch finished surfaces and building components using new materials to match existing.

3.05 PROTECTION OF EQUIPMENT

- A. After delivery, before and after installation, protect equipment and materials against theft, injury or damage from all causes.
- B. The Contractor shall receive, properly house, handle, hoist, and deliver to proper location, equipment and other materials required.
- C. The Contractor shall protect all materials and equipment in accordance with manufacturers' instructions.
 - 1. Protect UV sensitive products from direct sunlight.
 - 2. Support products to prevent sagging and bending.
 - 3. Provide climate-controlled storage as required for equipment and materials where ambient conditions exceed allowable storage conditions.

COMMON WORK RESULTS FOR ELECTRICAL

3.06 CLEANING AND FINISHING

- A. During the construction period, the Contractor shall remove all debris, rubbish, tools, equipment, unused materials, and the like, as required and/or requested by the Owner.
- B. Keep the premises in a clean and orderly condition during construction, removing all dirt, debris, and the like.
- C. Upon completion, the entire installation shall be thoroughly cleaned, all rubbish removed, and the installation left to the satisfaction of the Owner. Thoroughly clean all Electrical fixtures and equipment, including interior and exterior surfaces, to completely remove construction dust and dirt. Conduct a final inspection of the work and ensure that the piping has been cleaned and placed in complete and satisfactory working order.

END OF SECTION

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS & CABLES

PART 1 GENERAL

1.01 DESCRIPTION

- A. This Section describes wires, cables, and connectors.

1.02 REFERENCES

- A. ASTM: American Society for Testing and Materials:
1. ASTM B8: Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
 2. ASTM B33: Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes
 3. ASTM B172: Standard Specification for Rope-Lay-Stranded Copper Conductors Having Bunch-Stranded Members, for Electrical Conductors
 4. ASTM B189: Standard Specification for Lead-Coated and Lead-Alloy-Coated Soft Copper Wire for Electrical Purposes
- B. ICEA: Insulated Cable Engineers Association
1. ICEA 566-524: Cross-Linked Thermosetting Polyethylene Insulated Wire and Cable for Transmission and Distribution of Electrical Energy
 2. ICEA S-95-658: Non-shielded 0-2 kV Cable
 3. ICEA S-75-381: Portable and Power Feeder Cables for Use in Mines and Similar Applications
- C. NEC: National Electric Code
1. NEC Article 336: Power and Control Tray Cable, Type TC
- D. NEMA: National Electrical Manufacturers Association
1. NEMA WC 58: Portable and Power Feeder Cables for Use in Mines and Similar Applications
 2. NEMA WC 70: Power Cables Rated 2000 V or Less for the Distribution of Electrical Energy
- E. UL: Underwriters Laboratories:
1. UL 44: Thermoset-Insulated Wires and Cable
 2. UL 83: Thermoplastic-Insulated Wires and Cables
 3. UL 1277: Standard for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members
 4. UL 1581: Reference Standard for Electrical Wires, Cables, and Flexible Cords

1.03 SUBMITTALS

- A. Submit the following materials:
1. Lighting and receptacle circuit conductors.
 2. Single conductor 600-volt power and control conductors.
 3. Multi-conductor 600-volt power cable.
 4. Multi-conductor 600-volt control cable.
 5. Direct burial, multi-conductor 600-volt cable.
 6. Portable cord.
 7. Portable cable fittings.
 8. MC cable.
- B. Submittals of the following materials shall consist only of a listing of the manufacturer's name and the applicable catalog numbers of the items to be utilized. Upon review of the list, further information may be requested.
1. Connectors.
 2. Branch circuit conductor splices.
 3. Splices with compression fitting and heat-shrinkable insulator.
- C. Submit cable test data per testing requirements of Part 3.

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS & CABLES

PART 2 PRODUCTS

2.01 GENERAL

- A. With the exception of lighting and receptacle circuits, the type, size, and number of conductors shall be as specified on the drawings or schedules. Lighting and receptacle circuit conductors are unscheduled and shall be sized in accordance with the NEC to limit voltage drop to 3 percent.

2.02 COLOR CODING

- A. Power Conductors: Single-conductor power conductors shall have the following color codes for the indicated voltage:

	<u>480/277V</u>	<u>208/120V</u>	<u>240/120V</u>
Phase A	Brown	Black	Black
Phase B	Orange	Red	Red
Phase C	Yellow	Blue	--
Ground	Green	Green	Green
Neutral	Gray	White	White or Gray*
* If installed with 480/277V or 208/120V in the same raceway, box, gutter, or other enclosure, 240/120V neutral conductor color shall differ from the other system neutral conductor per NEC 200.6(D).			

- B. Multi-conductor power cable color coding shall be the manufacturer's standard.
- C. Cables sized No. 4 AWG and larger may be black with 3/4 inch vinyl colored plastic tape applied in 3 inch lengths around the cable at each end. The cables shall be colored at terminations and in pull boxes, handholes, and manholes.

2.03 LIGHTING AND RECEPTACLE CIRCUIT CONDUCTORS

- A. Lighting and receptacle circuit conductors shall be stranded except for No. 12 AWG which may be solid. Minimum conductor size shall be No. 12 AWG.
- B. Conductors shall have the following characteristics:
1. Voltage: 600 volts.
 2. Conductor: Bare annealed copper, stranded in accordance with ASTM B8.
 3. Insulation:
 - a. Dry Areas and Above Grade: THWN/THHN, 90°C dry, 75°C wet, polyvinylchloride (PVC) in accordance with UL 83
 - b. Dry/Wet Areas & Below Grade: XHHW, 90°C dry, 75°C wet, cross linked polyethylene in accordance with UL 44.
 4. Jacket: Nylon. Not applicable.
 5. Flame Resistance: UL 83. UL 44.
 6. Manufacturer: Cablec, Essex, Okonite, Southwire, or equal.

2.04 POWER CONDUCTORS AND CABLE, 600 VOLT

- A. Single Conductor:
1. Single conductor cable shall be stranded and used in conduits for power and control circuits. Unless otherwise specified, minimum size for power applications shall be No. 12 AWG and minimum size for control applications shall be No. 14 AWG.
 2. Conductors installed in cable tray shall be UL labeled, Type TC, designated for cable tray, installation in accordance with NEC Article 336.

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS & CABLES

3. Conductors shall have the following characteristics:
 - a. Voltage: 600 volts.
 - b. Conductor: Coated, Class B, stranded annealed copper in accordance with ASTM B8.
 - c. Insulation:
 - 1) Dry Areas & Above Grade: THWN/THHN, 90°C dry, 75°C wet, polyvinylchloride (PVC) in accordance with UL 83.
 - 2) Dry/Wet Areas & Below Grade: XHHW, 90°C dry, 75°C wet, cross linked polyethylene in accordance with UL 44.
 - d. Flame Resistance: IEEE 383 flame test. UL 44, UL 83.
 - e. Manufacturer: Anixter, Cablec, Essex, Okonite, Southwire, or equal.
- B. Multi-Conductor Cable: Multi-conductor cable may be used for power and control circuits. Cables shall be UL labeled, Type TC, designed for cable tray installation in accordance with NEC Article 336. The type of insulation, number of conductors, and size of conductor shall be as specified.
 1. Power Cable:
 - a. Multi-conductor power cable shall contain two, three, or four conductors, as specified, plus an equipment grounding conductor. Unless otherwise specified, minimum conductor size shall be No. 12 AWG.
 - b. Cable shall be provided with the following characteristics.
 - 1) Voltage: 600 volts.
 - 2) Conductors: Annealed copper, stranded in accordance with ASTM B8, coated in accordance with ASTM B33.
 - 3) Insulation: Ethylene propylene in accordance with UL 1581.
 - 4) Overall Jacket: Chlorosulfonated polyethylene (CSPE) in accordance with UL 1277. Minimum thickness 45 mils.
 - 5) Flame Resistance: 210,000 Btu/hr flame test, UL 1277.
 - 6) Manufacturer: Anixter, Okonite, or equal.

2.05 METAL CLAD (TYPE MC) BRANCH CIRCUIT CABLE

- A. Sheath: Steel or aluminum, of the interlocking metal type, continuous, and close fitting. The sheath shall not be considered a current carrying or grounding conductor.
- B. Conductors: Stranded insulated copper, of the same ampacity as the conduit/wire system indicated for the specific location. Provide separate green insulated grounding conductors in cable assembly. Type AC, armored cable, shall not be allowed. Conductor size shall be No. 12 AWG unless approved otherwise by the Owner. Conductor insulation shall comply with 600-volt power conductor requirements.
- C. Color Coding: Conductors in MC cables shall be color-coded as indicated above or identified with 3/4-inch vinyl colored plastic tape around the conductors at termination and splice points.
- D. Manufacturers: AFC Cable systems, Southwire, Okonite, or equal.

2.06 DIRECT-BURIED CABLE

- A. Cable for direct burial shall be multi-conductor MC cable. Cable shall be suitable for direct burial, suitable to be encased in concrete, and suitable for normal or Class 1, Division 2 atmospheres. Cable characteristics shall be as follows:
 1. Voltage: 600 volts.
 2. Conductor: Bare annealed stranded copper. Size and number of conductors shall be as specified on the circuit schedule.
 3. Insulation: Insulation shall be type XHHW, meeting ICEA 566 524 and UL 44.

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS & CABLES

4. Assembly: The individual conductors shall be cabled together with non-hydroscopic fillers and binder tape overall. An impervious, continuously corrugated aluminum sheath shall be welded over the cable core with a black flame-retardant PVC jacket of not less than 50 mils extruded over the armor. Non-welded type sheath is not acceptable. The armor shall meet the grounding conductor requirements of Table 250-95 of the NEC and UL requirements.
5. Manufacturer: Anixter, Cablec, Gardex, Okonite, Rockbestos, or equal.

2.07 PORTABLE CORD

- A. Portable cord shall be UL listed, type SO for sizes No. 10 AWG and smaller. Cords shall contain an equipment grounding conductor. Cord characteristics shall be as follows:
 1. Conductors: Flexible rope stranded in accordance with ASTM B189 and B33. Conductors shall be coated except ground conductors may be uncoated.
 2. Insulation: Insulation shall be ethylene propylene (EPR) or water resistant synthetic rubber (EPDM) and rated for continuous operation at 90° C.
 3. Jacket: Heavy-duty neoprene.
 4. Manufacturer: Anixter, or equal.
 5. Compliance: Meets or exceeds electrical and physical requirements of ICEA S-95-658/NEMA WC-70.
- B. Cords with conductors larger than No. 10 AWG shall be 600 volt, UL and/or MSHA listed, Type G. Cords shall contain an equipment grounding conductor. Cord characteristics shall be as follows:
 1. Conductors: Flexible rope stranded in accordance with ASTM B172 and B33. Conductors shall be coated except ground conductors may be uncoated
 2. Insulation: Insulation shall be ethylene propylene (EPR) or oil and water resistant synthetic rubber (EPDM) and rated for continuous operation at 90°C.
 3. Jacket: Extra heavy-duty thermoset CSPE.
 4. Manufacturer: AIWC, Americable, or equal.
 5. Compliance: Meets or exceeds electrical and physical requirements of ICEA S-75-381/NEMA WC-58.

2.08 SPLICING AND TERMINATING MATERIALS

- A. 600-Volt Conductor and Cable Connectors:
 1. Connectors shall be one-piece tool applied compression type of correct size and UL listed for the specific application. Connectors shall be tin-plated electrolytic copper. Connectors for wires No. 10 AWG and smaller shall be self-insulating ring tongue or locking spade terminals. Connectors for No. 8 AWG and larger shall be one-hole lugs up to size No. 3/0 AWG and two-hole or four-hole lugs for size No. 4/0 and larger. Mechanical clamp or screw type connectors are not acceptable.
 2. 120-Volt Branch Circuit Conductor Splices: Live spring type, Scotch-Lok, Ideal Wing Nut; self-stripping type, 3M Series 560; or equal.
 3. 600-Volt Branch Circuit Conductor Splices: #10 and #12 conductors may be live spring type, Scotch-Loc, Ideal Wing Nut; self-stripping type, 3M series 560; or equal.
 4. Only use in-line splices and taps where specifically called for on the drawings or by written consent of the Owner. Splices shall be compression type, made with a compression tool die approved for the purpose, as made by Thomas and Betts Corp., or equal. Splice shall be covered with a heat-shrinkable sleeve or boot.
- B. Portable Cable Fittings: Portable cable fittings for terminating the cable shall provide a watertight seal between the cord and the terminator and between the terminator and mounting hub. The cable terminator shall have a neoprene liner which grips the cord jacket when the back-nut on the fitting is tightened. In addition, on all pendant cord applications and other applications where called for, there shall be a stainless steel wire mesh cord grip as an integral part of the cord terminator.

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS & CABLES

PART 3 EXECUTION

3.01 GENERAL

- A. Wire shall be continuous between each end of a conduit. Splices and terminals are not permitted within a conduit run.
- B. Each main and branch circuit shall have its own dedicated neutral conductor. Do not install shared or common neutrals.
- C. Pull wire and cable into conduit or trays without damaging or putting undue stress on the cable insulation. UL listed pulling compounds are acceptable lubricants for pulling wire and cable. Grease is not acceptable. Raceway construction shall be complete, cleaned, and protected from the weather before cable is placed.
- D. Provide a cable support whenever a cable leaves a raceway.
- E. When flat bus bar connections are made with unplated bar, scratch-brush the contact areas. Torque bolts to the bus manufacturer's recommendations.

3.02 600-VOLT CONDUCTORS AND CABLE

- A. Incoming wire in panels, No. 6 AWG and smaller, shall be bundled and laced at intervals not greater than 6 inches, and neatly spread into trees and connected to their respective terminals. Allow sufficient slack in cables for alterations in terminal connections. Lace with plastic cable ties or linen lacing twine.
- B. Where plastic panel wiring duct is provided for wire runs, lacing is not necessary when the wire is properly installed in the ducts. Provide slack in junction and pull boxes and in handholes and manholes. Amount of slack shall be equal to the largest perimeter dimension of the box.
- C. Wire crossing hinges shall be stranded and made up into groups not exceeding 12 and shall be arranged so that they will be protected from chafing when the hinged member is moved.
- D. Terminate stranded wire as described in Part 2 except where terminals will not specifically accept such terminations. In these cases, terminate the wires directly on the terminal block. Install compression lugs and connectors using manufacturer's recommended tools.
- E. Solid wire shall not be lugged. Do not use electrical spring connectors, set screws, wire nuts, and wing nut connectors on anything other than solid wires in lighting and receptacle circuits. Install lugs and connectors with a compression tool.
- F. All splices and terminations are subject to inspection prior to and after insulating. Terminations at 460-volt motors shall be made by bolt-connecting the lugged connectors. Insulate and seal connections with factory-engineered kits. Motor connection kits shall consist of heat shrinkable, polymeric insulating material over the connection area and a high dielectric-strength mastic to seal the ends against moisture and contamination. Keep bolt connection area free of mastic and fillers to facilitate rapid stripping and re-entry. Motor connection kits shall accommodate a range of cable sizes for both in-line and stub-type configurations. Connection kits shall be independent of cable manufacturer's tolerances.
- G. In-line splices and tees (where approved) shall be made with tubular compression connectors and insulated with factory-engineered kits. Kits shall consist of heat shrinkable, polymeric insulating material over the connection area and a high dielectric strength mastic to seal the ends against moisture and contamination. Keep connection area free of mastic and fillers to facilitate rapid stripping and re-entry. Wires No. 10 AWG and smaller may be spliced using self-insulating connectors as specified in Part 2.
- H. In-line splices and tees (where approved) shall be made with tubular compression connectors and insulated as specified above for motor terminations, except that wires No. 10 AWG and smaller may be spliced using self-insulating connectors as specified in Part 2.
- I. Insulate splices and tees in underground handholes or pull boxes using Scotch-cast epoxy resin splicing kits. Provide conductor and cable markers at splice and termination points and use

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS & CABLES

self-insulating tubular compression connectors.

- J. Make terminations at solenoid valves, 120 volt, and other devices furnished with pigtail leads using self-insulating tubular compression connectors.

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS & CABLES

3.03 MC CABLE

- A. Use of metal clad (MC) cable is limited to light fixture connections only, in lengths not to exceed 6-feet.
- B. Use EMT or RMC conduit for all branch circuit homeruns to branch panelboards. Provide all enclosures and terminals to transition from MC cable to building wire, as required. Transition between MC cable and building wire shall be in an accessible junction box located as close to the load as possible.

3.04 PORTABLE CORD

- A. Portable cord feeding permanent installations, such as pumps, cranes, hoists, and portable equipment, shall have a wire mesh cord grip of flexible stainless steel wire to take tension from the cable termination. Use weatherproof strain relief fittings for all connections. Use 45 degree and 90 degree connectors where applicable to prevent unnecessary strain on cords. Flexible cords feeding submersible motors shall be of a non-wicking neoprene construction. Connect portable cords to permanent wiring with terminals. Use in-line taps and splices only where specified.
- B. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless steel, wire-mesh, strain relief device at terminations to suit application.

3.05 FIELD TESTING

- A. 600-volt rated conductors greater than or equal to 500 kcmil, or in parallel runs, shall be tested by the Contractor for continuity and shall be meggered after installation and prior to termination. Provide the megger, rated 1,000 volts d.c., and record and maintain the results, in tabular form, clearly identifying each conductor being tested; submit copies. Repeat testing after any cables are replaced.
 - 1. Replace cables when test value is less than 15 megohms.
 - 2. Cable test submittal shall include results, equipment used, date, and the Owner inspector's signature.

3.06 EXISTING CIRCUITS

- A. Confirm the destination and purpose of each existing circuit before connecting to new equipment and new wiring. Connections shown on the one-line diagram drawing are the preferred connections.
- B. Remove existing terminations leaving as much existing cable as possible. Conserve existing cable when making splices to new cables. Existing cable length may require different routings within manhole vaults than are shown on the drawings. Do not unnecessarily cut off any existing cable length.

END OF SECTION 26 0519

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 DESCRIPTION

- A. This Section describes a grounding system including a conduit system, equipment grounding conductor, transformer housings, a switchboard frame and neutral bus, motors, and miscellaneous grounds. Work also includes a 600V insulated main bonding jumper for service connection between the ground bus in the switchgear lineup and a ground termination point or service ground in the transformer.

1.02 REFERENCES

- A. NEC: National Electrical Code.
 - 1. NEC Article 250: Grounding and Bonding.

PART 2 PRODUCTS

2.01 GROUND CONDUCTORS

- A. Bare or green insulated copper for interior systems.
- B. Bare copper for underground or exterior systems.

2.02 CONNECTORS

- A. Cast, set screw, or bolted allowed in dry locations only.
- B. Form poured, exothermic welds.
- C. Compression-tool applied. Burndy "Hyground Compression System," or equal.
- D. Grounding lugs where furnished as standard manufacturer's items on equipment.

2.03 GROUND RODS

- A. Copperweld, 3/4-inch by 10-foot ground rods. Where ground wells are indicated, provide a 12-inch deep, 8-inch diameter precast concrete well with flush lid for accessibility and inspection of welded connections. RCP Vaults No. 12R12A with 12R12-t cover, or equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Size grounding conductors in accordance with National Electrical Code (NEC) Article 250, Tables 250-66 and 250-122.
- B. Underground connections shall be exothermic applied.
- C. Grounding conductor connectors shall be made up tight and located for future servicing and to ensure low impedance.
- D. Ground the electrical system, the cold-water service, structural steel, and transformers to the building ground grid.
- E. All plug-in receptacles shall be bonded to the boxes, raceways and grounding conductor.
- F. Provide equipment grounding conductor in all conduit runs.
- G. Provide ground bond for all conduits terminated at or near cable trays, including communication and data conduits provided for cabling to the cable tray.

3.02 EQUIPMENT

- A. Provide separate green insulated equipment ground conductor for all circuits. Effectively ground all fixtures, panels, controls, motors, disconnect switches, exterior lighting standards, and non-current-carrying metallic enclosures. Use bonding jumpers, grounding bushings, lugs, buses, etc., for this purpose.

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

- B. Provide grounding bushings on all feeder conduit entrances to panels and equipment enclosures and bond bushings to enclosures with minimum No. 10 AWG conductor. Connect the equipment ground to the building system ground. Use the same size equipment ground conductors as phase conductors, up through No. 10 AWG.

END OF SECTION 26 0526

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 DESCRIPTION

- A. This Section describes supporting devices for electrical equipment, associated conduit, and cable.

1.02 REFERENCES

- A. IBC: International Building Code
 - 1. IBC Chapter 16: Structural Design
- B. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association
 - 1. SMACNA Seismic Restraint Manual - Guidelines for Mechanical Systems, for Seismic Hazard Level (SHL)

1.03 SUBMITTALS

- A. Submit shop drawings and calculations for seismic anchorage and bracing for the vertical and lateral restraint of conduit, cable trays, bus ducts, and electrical equipment as required by IBC Chapter 16 and the SMACNA Seismic Restraint Manual – Guidelines for Mechanical Systems, for Seismic Hazard Level (SHL) A. Shop drawings and calculations shall bear the seal of a professional engineer registered in the state of Oregon.

PART 2 PRODUCTS

2.01 PRODUCTS

- A. Hangers: Kindorf B-905-2A channel, H-119-D washer, C105 strap, minimum 1/2-inch rod with ceiling flange, or equal.
- B. Pipe Straps: Two-hole galvanized or malleable iron.
- C. Support of Open Cabling: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
 - 2. Lacing bars, spools, J-hooks, and D-rings.
 - 3. Straps and other devices.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide all electrical equipment supports.
- B. Install vertical support members for equipment, straight and parallel to building walls.
- C. Provide independent supports to structural member for electrical fixtures, materials, or equipment installed in or on ceiling, walls, or in void spaces and/or over furred or suspended ceilings.
- D. Do not use other trades' fastening devices to support electrical equipment materials or fixtures.
- E. Do not use supports and/or fastening devices to support other than one particular item.
- F. Support conduits within 18 inches of outlets, boxes, panels, cabinets, and deflections.
- G. Provide complete seismic anchorage and bracing for the vertical and lateral restraint of conduit, cable trays, bus ducts, and electrical equipment as required by IBC Chapter 16 and the SMACNA Seismic Restraint Manual - Guidelines for Mechanical Systems, for SHL A.
- H. Building Attachments:
 - 1. Where possible, support all conduit, cable tray, and equipment from structural members, beams, and joists.
 - 2. Provide structural steel angles, channels, or other members to support conduit, cable tray, and equipment where structural members do not occur as required for proper support.

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

3. Arrange supports to prevent eccentric loading of joists and joist girders. Locate supports at joist panel points or provide web reinforcing as required.
4. Do not fasten or attach to unfilled steel roof deck structure.

3.02 LUMINAIRES

- A. Light-Duty Ceiling Systems:
 1. Attach No. 12 hanger wire from each corner of the luminaire to the structure above.
 2. Positively and securely attach luminaire within 6 inches of each corner to the suspended ceiling framing member by mechanical means.
- B. Intermediate-Duty Ceiling Systems:
 1. Positively and securely attach luminaire within 6 inches of each corner to the suspended ceiling framing member by mechanical means.
 2. Attach No. 12 hanger wire within 3 inches of each corner of each luminaire.
 3. Connect two 12-gauge slack wires from the luminaire housing to the structure above for luminaires weighing less than 56 pounds.
 4. Support luminaires weighing 56 pounds or more directly from the structure above with approved hangers attached to each corner of the luminaire.
- C. Heavy-Duty Ceiling Systems:
 1. Positively and securely attach luminaire within 6 inches of each corner to the suspended ceiling framing member by mechanical means.
 2. Connect two 12-gauge slack wires from the luminaire housing to the structure above for luminaires weighing less than 56 pounds.
 3. Support luminaires weighing 56 pounds or more directly from the structure above with approved hangers attached to each corner of the luminaire.

3.03 PULL AND JUNCTION BOXES

- A. Pull and junction boxes installed within the cavity of a suspended ceiling that is not a fire rated assembly may be attached to the suspended ceiling framing members, provided the following criteria are met:
 1. Installation complies with the ceiling system manufacturer's instructions.
 2. Pull or junction box is not larger than 100 cubic inches.
 3. The pull or junction box is supported to the main runner with two fastening devices that are designed for framing member application and positively attach or lock to the member.
 4. The pull or junction box serves branch circuits and associated equipment in the area.
 5. The pull or junction box is within 6 feet of the luminaires supplied.
 6. The framing members are not rotated more than 2 degrees after installation.
- B. Pull and junction boxes installed within the cavity of a suspended ceiling may be attached to independent support wires, provided the following criteria are met:
 1. Independent support wires are taut and connected at both ends, one end to the ceiling framing member and the other to the structure above.
 2. Pull or junction box is not larger than 100 cubic inches.
 3. The pull or junction box is secured to the independent support wires by two fastening devices that are designed for the application.
 4. Independent support wires in a fire-rated ceiling are distinguishable by color, tagging or other effective means.

3.04 CABLES AND RACEWAY

- A. Cables and raceway installed within the cavity of a suspended ceiling may be attached to independent support wires provided the following criteria are met:
 1. Independent support wires are taut and connected at both ends, one end to the ceiling framing member and the other to the structure above.
 2. Raceways are not larger than one inch trade size and cables and bundled cables are not larger than one inch diameter including insulation.

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

3. Not more than three raceways or cables are supported by any independent support wire and are supported within the top or bottom 12 inches.
 4. Cables for telecommunications, data processing, Class 2 power-limited signaling systems, fiber optics, and other power limited systems are securely fastened within 2 feet of each termination and at intervals not to exceed 5 feet or per the manufacturer's installation instructions.
 5. Raceways are secured at intervals required for the type of raceway installed.
 6. Cables and raceway are secured to independent support wires by fastening devices and clips designed for the purpose.
 7. Independent support wires are distinguishable by color, tagging, or other effective means.
- B. Cables and raceway installed within the cavity of a suspended ceiling may be supported with trapezes constructed of steel rods and channels provided the following criteria are met:
1. The size of the rods, channel, and fastening devices are suitable for the anticipated weight.
 2. The spacing of the trapezes meets that required for the type of raceway installed.
 3. Cables and raceway are secured to a trapeze by straps designed for the purpose.
 4. Cables and raceway do not support other raceway or cables.
 5. An appropriately sized seismic bracing system is installed.

END OF SECTION

RACEWAY & BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 DESCRIPTION

- A. This Section describes raceways, conduits, and boxes for electrical systems wiring, including all fittings, hangers, and appurtenances.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems
- B. Section 26 05 53 - Identification for Electrical Systems
- C. Section 26 27 26 - Wiring Devices

1.03 REFERENCES

- A. ANSI: American National Standards Institute:
 - 1. ANSI C80.1: Electrical Rigid Steel Conduit
 - 2. ANSI C80.3: Steel Electrical Metallic Tubing
 - 3. ANSI C80.4: Fittings for Rigid Metal Conduit and Electrical Meta
- B. ASTM: American Society for Testing Materials:
 - 1. ASTM A193: Standard Specification for Alloy-Steel and Stainless-Steel Bolting for High Temperature or High-Pressure Service and Other Special Purpose Applications
 - 2. ASTM E814: Standard Test Method for Fire Tests of Penetration Firestop Systems
- C. JIC: Joint Industrial Council
 - 1. JIC EMP-1: Electrical
- D. NEC: National Electrical Code:
- E. NEMA: National Electrical Manufacturers Association.
 - 1. NEMA RN 1: Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
 - 2. NEMA TC2: Electrical Polyvinyl Chloride (PVC) Tubing and Conduit
 - 3. NEMA Product and Installation Standards.
- F. NFPA: National Fire Protection Association:
 - 1. NFPA 70: National Electrical Code
- G. TIA: Telecommunications Industry Association/Electronic Industries Association
 - 1. TIA 569-A: Commercial Building Standard for Telecommunications Pathways and Spaces
- H. UL: Underwriters Laboratories:
 - 1. UL 360: Standard for Liquid-Tight Flexible Metal Conduit
 - 2. UL 651: Rigid Nonmetallic Electrical Conduit
 - 3. UL 651A: High-Density Polyethylene Conduit
 - 4. UL 1479: Intermediate Metal Conduit.

1.04 DEFINITIONS

- A. "Where subject to physical damage," is defined as a surface installation within an 8-foot zone above a finished floor, in areas subject to vehicular traffic, including manually operated forklifts.

1.05 SUBMITTALS

- A. Submittals for the following materials shall consist only of a listing of the manufacturer's name and the applicable catalog numbers of the items to be utilized. Upon review of this list, further information may be requested.
 - 1. Conduit.
 - 2. Conduit fittings.
 - 3. Supports.

RACEWAY & BOXES FOR ELECTRICAL SYSTEMS

- B. Submittals for the following materials shall be complete with detailed information and cut sheets.
 - 1. Wireway and wire gutters.
- C. Provide as-constructed drawing information identifying final conduit routing and box locations upon completion of the work.

1.06 QUALITY ASSURANCE

- A. Products shall be new and certified by an approved testing laboratory.

PART 2 PRODUCTS

2.01 GENERAL

- A. Materials shall be of current standard design and shall conform to the established standards of an approved testing laboratory. Like items shall be of the same manufacturer and type.

2.02 METALLIC CONDUITS

- A. Galvanized Rigid Steel Conduit (GRSC):
 - 1. Heavy wall construction, manufactured in conformance with ANSI C80.1 and listed as UL 6 approved.
- B. Electrical Metallic Tubing (EMT):
 - 1. Thin wall electrogalvanized steel, manufactured in conformance with ANSI C80.3 and listed as UL 797 approved.
- C. PVC Coated Rigid Steel Conduit and Fittings:
 - 1. ANSI C80.1 hot-dipped galvanized rigid steel conduit with an external 0.040" minimum PVC protective coating per NEMA Standard RN 1. Both ends of conduit shall be threaded with thread protectors, factory installed. Fittings shall be threaded type ANSI C80.4, hot-dipped galvanized, with a 0.055" minimum PVC protective coating. PVC coating on fittings shall match the coating on the PVC coated conduit.
- D. Flexible Metal Conduit:
 - 1. Manufactured from hot dipped galvanized steel manufactured in conformance with UL standards. Flexible metal conduit shall be a minimum of 1/2-inch standard trade size.
- E. Liquid-Tight, Flexible Metal Conduit:
 - 1. Conduit shall have a ground wire.
 - 2. Aluminum or galvanized flexible metal conduit shall have a polyvinylchloride chemical resistant jacket in conformance with the requirements of UL 360. Acceptable manufacturers are Sealtight, or equal.
- F. Explosion-Proof Flexible Conduit:
 - 1. Watertight flexible conduit shall be suitable for use in Class I, Division 1, Group D hazardous areas as specified in NFPA No. 70.

2.03 RIGID NON-METALLIC CONDUITS

- A. Polyvinylchloride (PVC) Conduit:
 - 1. PVC conduit shall be Type II, in conformance with NEMA TC2 and the following:
 - a. Schedule 40, high impact.
 - b. Suitable for use with 90°C rated wire.
 - c. Conform to UL Standard 651 and carry appropriate UL listing for above and below ground use.
- B. High-Density Polyethylene (HDPE) Conduit:
 - 1. HDPE conduit shall be the following:
 - a. Schedule 40, high impact.
 - b. Suitable for use with 90°C rated wire.
 - c. Conform to UL Standard 651A and have appropriate UL listing for below-ground use.

RACEWAY & BOXES FOR ELECTRICAL SYSTEMS

2.04 METALLIC BOXES

- A. Flush and Concealed Outlet Boxes:
 - 1. Galvanized stamped steel with screw ears for device ring mounting, knock-out plugs, mounting holes, and fixture studs if required. Acceptable manufacturers are RACO, or equal.
- B. Surface Outlet Boxes (Interior Locations):
 - 1. Boxes for use on ceilings shall be galvanized stamped steel with screw ears for device ring mounting, knock-out plugs, mounting holes, and fixture studs if required. Acceptable manufacturers are RACO, or equal.
 - 2. Boxes for use on walls below 8-feet or where noted on drawings shall be cast steel or aluminum with threaded hubs.
- C. Large Boxes:
 - 1. When required, boxes exceeding 4 11/16-inches square shall be welded steel construction with screw cover and painted, steel gauge matching physical size. Acceptable manufacturers are Hoffman, Circle AW, or equal.
- D. Floor Boxes:
 - 1. Boxes in concrete floors shall be adjustable flush power floor boxes with aluminum duplex service tops. Acceptable manufacturers are Hubbell 825 29/SA 3925, or equal.
 - 2. Boxes on flush ducts shall have service fittings as required. Equip outlets with receptacles as specified in Section 26 2726. Acceptable manufacturers are Hubbell SC-3900 series, or equal.

2.05 BOXES AND FITTINGS

- A. Sheet Metal Boxes and Fittings:
 - 1. Boxes and fittings installed in areas where electrical metallic tubing is specified shall be standard UL-approved sheet steel type.
- B. Cast Ferrous Alloy Boxes (Outside Locations):
 - 1. Hot-dipped galvanized cast ferrous alloy unless otherwise specified.
 - 2. Conduit entrances shall be integrally cast threaded hubs or bosses and shall provide for full 5-threaded contact on tightening. Drilling and threading shall be done before galvanizing.
 - 3. Device covers shall be suitable for boxes, with full-body neoprene gaskets to fit the devices and boxes used.
 - 4. Cover plates shall be hot-dipped galvanized cast ferrous alloy unless the particular device requires a cover that is not manufactured in this material.
 - 5. Type 304 stainless steel screws shall be provided for covers.
 - 6. Where two or more devices are located together, outlet and device boxes shall be gang type.
 - 7. Device boxes shall be FD boxes as manufactured by Crouse-Hinds, Appleton, or equal.
- C. Floor Boxes:
 - 1. Hot-dipped galvanized cast boxes with a NEMA 4 rating.
 - 2. Boxes shall have a recessed ring neoprene gasket, and checker plate covers.
 - 3. Cover fasteners shall be 316 stainless steel machine screws of not less than 1/4-inch diameter. The cover screws shall be flathead socket-type recessed screws, countersunk below the level of the cover.
- D. Steel Sheet Boxes (Outside Locations):
 - 1. Boxes larger than Type FD shall be fabricated from steel plating and shall be hot-dipped galvanized. The thickness of the steel plating shall conform to the requirements of JIC. Before finish galvanizing, furnish and install a grounding pad drilled for two-bolted grounding lugs or with a grounding stud welded to the inside of the box.
 - 2. Provide 316 stainless steel hardware.

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3. Boxes shall, as a minimum, meet NEMA 12 and JIC requirements and shall be NEMA 4 where exposed to weather or water.
4. Galvanized sheet steel boxes may be used in protected areas where electrical metallic tubing is specified. Boxes shall be a minimum of 4-inches square.
- E. Boxes and Fittings for Hazardous Locations:
 1. In locations specified as Class I, Divisions 1 or 2, hazardous, boxes and fittings shall be NFPA No. 70, explosion-proof, in addition to the requirements specified above.
 2. Seals for conduit systems shall be hot-dipped galvanized cast ferrous alloy, and each seal shall be of suitable configuration for the individual circumstance. Sealing compound shall be hard type, Chico A, or equal, and shall be UL listed for explosion-proof sealing fittings.
- F. Boxes and Fittings in Corrosive Locations:
 1. Surface boxes and fittings located in areas specified as corrosive shall be NEMA 4X. Conduit entering plastic boxes and exposed metal on plastic boxes which are not isolated from the interior of the box shall be bonded together with a suitable grounding conductor.
 2. Seals for entry in corrosive locations shall be oblong conduit bodies filled with soft non-setting compound.
- G. Terminal Cabinets:
 1. Meet NEMA 12 and JIC requirements as a minimum, be made from sheet steel, and have hinged doors. Cabinets exposed to weather or moisture shall meet NEMA 4X requirements.
 2. Except for those located in electrical equipment rooms, cabinets shall be finished inside and out with a powdered thermosetting resin system resistant to abrasion, moisture, acids, alkalis, high temperatures, and flame.
 3. Exterior color shall be gray. Interior color shall be white.
 4. Before finish is applied, a copper grounding pad for a two-bolt grounding lug or grounding stud shall be provided inside the cabinet.
 5. Provide 316 stainless steel hardware.
 6. Terminal cabinets shall have terminal blocks of size and capacity for the required loads and shall be rated 30 amperes, 600V AC minimum. Contacts shall be No. 8 minimum strap screw of a type suitable for ring tongue or locking spade terminals. Similar cabinet with a mounting panel shall be provided for mounting miscellaneous field equipment.
- H. Hubs:
 1. Hubs for connection of conduit to junction, device, or terminal boxes shall be made of cast ferrous alloy, electroplated with zinc, and shall have insulating bushings.
 2. Hubs shall contain a neoprene O-ring and shall provide a watertight connection.

2.06 CONDUIT FITTINGS

- A. GRSC:
 1. Fittings, including couplings, shall be threaded unless otherwise approved by the Owner.
 2. Threadless Couplings and Connectors:
 - a. GRSC couplings and box connectors may be steel threadless, compression ring, or set screw type for use with conduits 1-inch and smaller installed in poured concrete locations where limited working space makes threaded fittings impractical.
 - b. Threadless fittings are not acceptable for use with GRSC conduits except as allowed above. They may, however, be used with EMT type conduits.
 3. Myers hubs or equal shall be used with NEMA 2, 3, 3R, 4, and 12 enclosures.
 4. Threaded Locknuts:
 - a. Sealing type may be used with NEMA 2, 3, 3R, 4, and 12 enclosures at bottom penetrations.
 - b. Extra-heavy electrogalvanized steel for sizes up to 2-inches. Locknuts larger than 2-inches shall be electrogalvanized malleable iron.

RACEWAY & BOXES FOR ELECTRICAL SYSTEMS

5. Threaded Bushings:
 - a. 1 1/4-inch and larger, insulated, grounding type as required in Section 26 0526.
 - b. Electrogalvanized malleable iron with insulating collar.
 - c. Locking type and provided with a feed-through compression lug for securing the ground cables.
6. Unions shall be electrogalvanized ferrous alloy type. Acceptable manufacturers are Appleton, UNF or UNY; Crouse-Hinds, UNF or UNY; or equal.
7. Conduit bodies shall be ferrous alloy type (malleable iron), with clamp type fastening covers.
8. Gaskets shall be neoprene.
- B. EMT:
 1. EMT couplings and connectors shall be watertight compression type or set screw type with steel bodies, zinc or cadmium coated. Die cast fittings will not be permitted.
 2. Connectors shall be steel compression ring or set screw type for conduit termination, with insulated throat, suitable for the application.
 3. Couplings shall be steel compression ring or set screw type.
- C. Flexible Metal Conduit:
 1. Fittings shall be 2-screw steel body type, zinc, or cadmium coated. Die cast fittings will not be permitted.
- D. Liquid-Tight, Flexible Metal Conduit:
 1. Fittings for liquid-tight conduit shall have a cadmium-plated malleable iron body and gland nut with cast-in lug, brass grounding ferrule, threaded to engage conduit spiral and O-ring seals around the conduit and box connection and insulated throat. Use 45-degree and 90-degree fittings where necessary.
 2. Fittings shall be threaded and compression type for polyvinyl jacketed flex.
- E. Weatherproof Connectors:
 1. Provide threaded connectors.
- F. Expansion Couplings:
 1. Provide O.Z. type EX couplings with jumper. Gedney, or equal.
- G. Seal-Offs:
 1. Provide seal-offs with filler fiber, compound, and removable cover.
- H. HDPE Conduit:
 1. HDPE couplings and connectors shall be UL listed and specifically designed for HDPE applications.
 2. HDPE connectors and joints shall be made by a method approved by the Owner. PVC glue is not permitted on HDPE.

2.07 METALLIC RACEWAYS

- A. Surface Metal Raceway (SMR):
 1. Provide raceway with snap-on cover, sized as shown on the drawings. Acceptable manufacturers are Wiremold, Walker, or equal.

2.08 RACEWAY SUPPORTS

- A. Conduit Supports:
 1. Hot-dipped galvanized (exterior) or electrogalvanized (interior) steel framing channel to support groups of conduits.
 2. Use one-hole galvanized malleable iron pipe straps with galvanized clamp backs and nesting backs where required.
 3. Use one-hole galvanized steel pipe straps on studs for interior applications.
 4. Supports for PVC coated rigid steel shall be PVC coated straps, struts, or hangers.

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- B. Ceiling Hangers:
 - 1. Adjustable galvanized carbon steel rod hangers in conformance with ASTM A193. Rods shall be minimum 1/2-inch in diameter, threaded continuously.
 - 2. Use stainless steel hanger rods where rods will be located in corrosive areas and exposed to the effects of weather or moisture.
 - 3. Steel support wire hangers with fastening devices and clips designed as applicable to the work.
- C. Structural Attachments (Racks):
 - 1. Hot-dipped galvanized steel framing channel.
 - 2. Treat field cuts with zinc-enriched paint.

2.09 WIREWAYS

- A. Wireway and auxiliary gutters shall meet JIC, EMP-1 standards, shall be sectional flanged oil-tight type with hinged covers, and shall be 8-inches in cross section unless otherwise specified.
- B. Troughs shall be painted steel, square in cross section, with screw covers. Use gasketed, weatherproof type for exterior applications.
- C. Fittings, tees, elbows, and couplings shall be as needed for configurations shown on the drawings.

2.10 MISCELLANEOUS PRODUCTS

- A. Provide watertight seals at penetrations through exterior walls or walls exposed to moisture. Acceptable manufacturers are type CSMC by O.Z. Gedney Co., Link Seal by Thunderline Corp., or equal.
- B. Provide waterproof firestops and seals in specified locations. Acceptable manufacturers are Flamemastic 71A, Vimasco No. 1-A, or equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General:
 - 1. Existing boxes and raceways, exposed under this contract, shall be properly supported per NEC before cover approval.
 - 2. All conduit and wireway installations shall comply with NEMA, "Standards of Installation."
 - 3. Cutting or notching shall be kept to a minimum, using only approved methods. Structural members shall not be disturbed or cut in any way without specific written approval from the Owner, on a case-by-case basis. Patch and correct finished surfaces damaged by electrical work. Fire barriers shall be returned to their original condition using materials of equal or higher fire rating and specifically designed for that use.
 - 4. Unless otherwise noted on the drawings, all conduit work in finished spaces shall be concealed. Exposed conduit is acceptable only when and where prior specific authorization for use is obtained from the Owner.
 - 5. Conceal all conduits in finished spaces and elsewhere so far as practicable. Concealed conduits shall run in a direct line with long sweep bends and offsets. Where conduit runs between junction boxes and/or devices, route conduit vertically below ceiling level. Where horizontal runs are required, route above ceiling level for future flexibility.
 - 6. Route exposed conduit parallel or at right angles to structural building lines and neatly offset into boxes. Conduits attached directly to building surfaces shall closely follow the surfaces. Conduit fittings may be used to "saddle" under beams.
 - 7. Route conduit in existing racks whenever possible.
 - 8. Cut conduits square, ream smooth, and draw fittings up tight with at least five threads fully engaged.

RACEWAY & BOXES FOR ELECTRICAL SYSTEMS

9. Conduits, whether exposed or concealed, shall be securely supported and fastened at minimum intervals of 6-feet and within 18-inches of each outlet, elbow, fitting, panel, and the like. Support suspended conduits with metal ring or trapeze hangers on threaded, steel rods having a safety factor of four.
 10. During construction, keep conduit and raceways closed with suitable plugs or caps to prevent entrance of dirt, moisture, concrete, or foreign objects. Raceways shall be clean and dry before installation of wire and at the time of acceptance.
 11. Pack spaces around conduits with oakum and seal to prevent entrance of moisture where conduits are installed in sleeves or block-outs which penetrate moisture barriers.
 12. Install intumescent material around ducts, conduits, and the like to prevent spread of smoke or fire where installed in sleeves or block-outs which penetrate rated fire barriers. The penetration sealing system shall be capable of passing a 3-hour test per ASTM E814 (UL 1479) and shall consist of a material capable of expanding when exposed to temperatures of 250-350°F. An alternate method utilizing intumescent materials in caulk and/or putty form may be used.
 13. Provide GRSC on underground conduit runs at 60-degree and larger bends, and where conduits exit concrete.
 14. Underground stub-ups shall use wrapped or PVC coated rigid steel galvanized 90-degree elbows with a minimum radius not less than that permitted by code, or as noted on the drawings. Conduit risers from these elbows shall be wrapped or PVC coated rigid steel galvanized conduit. Extend GRSC 18-inches beyond penetrations.
 15. Existing raceways exposed under this contract shall be properly supported per NEC before cover approval.
- B. Conduit Runs Between Pull Boxes:
1. Limit the number of directional changes of the conduit to a maximum total of 270 degrees in any run between pull boxes.
 2. Limit the number of directional changes of the conduit to a maximum of 180 degrees in any run between pull boxes for communications conduits, unless otherwise approved by the Owner.
 3. Limit conduit runs to 400-feet, less 100-feet for each 90 degrees of change in direction.
 4. Avoid bends and offsets whenever possible. However, when bends and offsets are necessary, they shall be factory bends or bends made with a hickey or conduit bending machine. Heating, welding, or brazing the conduit for bends is not acceptable.
- C. Junction and Pull Boxes:
1. Where required for pulling cable and as necessary to meet NFPA No. 70, provide cast junction boxes or pull boxes. Pull boxes used for multiple conduit runs shall not combine circuits fed from different MCC's, switchboards, or switchgear.
- D. Conduit Terminations:
1. Conduit entering sheet steel boxes or cabinets shall be secured by locknuts on both the interior and exterior of the device and shall have an insulating grounding or bonding bushing constructed over the conduit end.
 2. Conduit entering top or sides of NEMA 3R, 4, and 12 boxes shall be terminated with a rain-tight hub having an insulated liner.
 3. Surface-mounted cast boxes and plastic enclosures shall have threaded hubs.
 4. Joints shall be made with standard couplings or specified unions.
 5. Metal parts of plastic or coated control stations and coated boxes shall be bonded to the conduit system.
 6. Running threads shall not be used in lieu of nipples, nor shall excessive thread be used on any conduit.
 7. The ends of conduit shall be cut square, reamed, and threaded with straight threads.
 8. Male threads on rigid steel conduit shall be coated with electrically conductive, zinc rich paint.

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9. Steel conduit shall be made up-tight, with thread compound.
- E. Conduit Support:
 1. Exposed metallic conduit shall be run on supports spaced not more than 6-feet apart unless noted otherwise on the drawings and shall be constructed with runs parallel or perpendicular to walls, structural members or intersections of vertical planes and ceiling.
 2. Exposed PVC conduit shall be run on supports spaced not more than 3-feet apart for conduits up to 1-inch, 5-feet apart for conduits 1 1/4-inches to 2-inches, and 6-feet apart for conduits 2 1/2-inches and larger.
 3. No conduit shall approach closer than 6-inches to any object which operates above the rated temperature of the cable insulation it contains.
 4. Conduit, except PVC, supported directly from the concrete structure shall be spaced at least 1/4-inch using one-hole, hot-dipped galvanized, malleable iron straps with nesting backs or, if three or more conduits are located in parallel run, they may be spaced from the wall approximately 5/8-inch to 1-inch by means of framing channel.
 5. Runs of individual conduit suspended from the ceiling shall be supported with galvanized carbon steel rod hangers. Where three or more conduits are suspended from the ceiling, steel racks shall be constructed.
 6. PVC conduit supported directly from the concrete structure shall be spaced out at least 1/4-inch using PVC conduit wall hangers.
 7. Conduit rack and tray supports shall be secured to concrete walls and ceilings by means of cast-in-place anchors, die-cast rust-proof expansion shields, or cast flush anchors. Wooden plugs, plastic inserts or gunpowder-driven inserts are not acceptable as a base to secure conduit supports.
 8. Runs of individual conduit suspended from the ceiling shall be supported with galvanized carbon steel rod hangers or wire hangers. Where three or more conduits are suspended from the ceiling, steel racks shall be constructed.
- F. Conduit Penetrations:
 1. Conduit routed through floors, walls, or other concrete structures shall pass through cast-in-place openings wherever possible. In cases where cast-in-place openings are not possible, use appropriately sized holes which will not impair the structure's integrity. After completion, grout and caulk surface to be watertight and refinish to match existing surroundings.
 2. Install watertight seals wherever conduits penetrate concrete wall panels or walls to the outdoors.
 3. Install firestops and seals at penetrations through building floors, walls, or where required by fire codes.
 4. Provide waterproof firestops and seals in specified locations.
- G. Raceway Separation:
 1. Whenever possible, separate signal raceways from AC power or control raceways a minimum of 12-inches.
- H. Conduit Seals for Hazardous Areas:
 1. Each conduit passing from a hazardous or corrosive area into a non-hazardous or non-corrosive area shall be provided with a seal fitting which may be located on either side of the boundary. The seal shall be located at the boundary in accordance with NEC requirements.
- I. Expansion Joints and Expansion Couplings:
 1. At expansion joint crossings and where noted on the drawings, verify maximum design deflection. Use expansion coupling fittings. At crossings of expansion joints with 1 1/2-inch conduit and smaller, flex conduit may be used where acceptable.

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J. PVC Coated Conduit:

1. Conduit and fittings shall be installed such that the PVC coating is continuous and watertight and that no portion of the metal conduit or fittings is exposed to moisture. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.
2. When clamping PVC coated conduit in a pipe vise, replace the jaw assembly with special vise adapters that do not damage the coating. When clamping in a chain vise for diameters less than 2-inches, wrap the clamp area with emery cloth (coarse surface against the coating). Use half-shell clamps for 2-inch and larger diameter PVC coated conduit.
3. Cut PVC coated conduit using a roller cutter and remove about a 1/4-inch of the exterior PVC coating to aid in threading the conduit. Use a reamer to remove any rough internal edges.
4. After threading is complete, clean the threads and conduit interior with a degreasing spray to prepare for the application of the touchup compound to ensure good adherence to the unprotected metal substrate.
5. When utilizing a hydraulic bender, use equipment designed to bend PVC coated conduit. If using a conventional hand bender, use the next larger size bending shoe to allow space for the coating. Make hand bends using a specially coated bending hickey to reduce the potential coating damage when making sharp bends, saddles, or offsets.
6. Use special Z wrenches or strap wrenches (in lieu of standard adjustable pliers) to assemble PVC coated conduit and fittings to prevent damage to the coating. For small conduit sizes, Spin-It tools may be used to assemble the conduit and fittings. Apply touchup compound to any exposed threads, joints, scrapes, or nicks.

K. Epoxy Coated Conduit:

1. Make conduit up-tight with strap wrenches. Do not use pipe wrenches and channel locks for tightening. Patch damaged areas with the manufacturer's recommended materials. Build the patched area up to the full thickness of the original coating.

L. Liquid-Tight, Flexible Metal Conduit:

1. Use liquid-tight in accordance with JIC standards and the following:
 - a. Where specified or indicated on the drawings.
 - b. Where flexibility is required for electrical raceways on equipment.
 - c. For motor mounts.
2. The maximum length of conduit shall be 24-inches for conduits 1 1/2-inches or smaller and 36-inches for conduits 2-inches or larger. The terminating fittings and sealing shall be as specified.

M. Non-Metallic Conduit:

1. Elbows, offsets, or 60-degree and larger bends in direct buried or concrete embedded conduit runs shall be galvanized rigid steel. The final length of conduit runs which rise up through concrete slabs or curbs shall be galvanized rigid steel, provided with grounding bushing.
2. Make connections with waterproof solvent cement.
3. PVC conduit entering fiberglass boxes or cabinets shall be secured by threaded bushings on the interior of the device and shall be terminated with a threaded male terminal adapter having a neoprene O-ring. Joints shall be made with standard couplings.

N. Galvanized Rigid Steel Conduit (GRSC):

1. GRSC embedded in concrete below grade or in damp locations shall be made watertight by painting the entire male thread with metal primer paint before assembly.

RACEWAY & BOXES FOR ELECTRICAL SYSTEMS

3.02 INSTALLATION OF RACEWAYS FOR COMMUNICATIONS

- A. Comply with TIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- B. Communications conduit bends shall be large-radius field bends or manufactured conduit sweeps and long-radius elbows. Do not install cast type fittings or sharp bends.
- C. Installation in Equipment Rooms:
 - 1. Protect existing telephone terminals and equipment which will remain in service during construction from mechanical injury and dust entry.
 - 2. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
 - 3. Install cable runway to route cables if conduits cannot be located in these positions.
 - 4. Secure conduits to backboard when entering room from overhead.
 - 5. Extend conduits 6-inches above finished floor or 12-inches down from ceiling, terminating in insulating bushings.
 - 6. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

3.03 INSTALLATION OF RACEWAYS AND BOXES FOR FIRE ALARM.

- A. Fire alarm conduit and boxes installed in concealed locations or located in stairwells, storage rooms, electrical rooms, mechanical rooms, and utility rooms shall be factory-painted red.
- B. Exposed fire alarm conduits in finished spaces shall be painted to match adjacent wall and ceiling finishes.

3.04 BOXES

- A. Installation:
 - 1. Mount boxes and outlets at center line, at heights shown on the drawings.
 - 2. Install outlet boxes, sized by code, large enough to accommodate all wires, fittings, and devices.
 - 3. Install multi-gang boxes as required to accept devices with no more than one device per gang.
 - 4. Equip all metallic boxes with grounding provisions.
 - 5. Flush wall switch, and receptacle outlets used with conduit systems shall be a minimum of 4-inches square, 1 1/2-inches or deeper, with a one- or two-gang plaster ring mounted vertically. Where three or more devices are at one location, use a one-piece multiple gang tile box or a gang box with a suitable device ring.
 - 6. Wall bracket and ceiling, surface-mounted lighting fixture outlets shall be a minimum of 4-inches square and 1 1/2-inches deep with a 3/8-inch fixture stud where required. Wall bracket outlets shall have a single-gang opening where required to accommodate fixture canopy. Provide larger boxes or extension rings where the quantity of wires installed requires more cubic capacity.
 - 7. Boxes for communication systems shall be a minimum of 4 11/16-inches square and 3 1/2-inches deep. Provide communication outlet boxes with a one-gang plaster ring mounted vertically.
 - 8. Boxes for special systems shall be suitable for the equipment installed. Coordinate size and type with the system supplier.
 - 9. Install pull boxes where shown on the drawings or required by code. Use galvanized boxes of the size required by code with removable covers installed so that covers will be accessible after work is completed.
 - 10. Install boxes flush with finished surfaces or not more than 1/8-inch back and install boxes level and plumb. Long screws with spacers or shims for mounting devices are not acceptable. Do not expose combustible materials to wiring at outlets.

RACEWAY & BOXES FOR ELECTRICAL SYSTEMS

11. Extend covers for flush mounted boxes in finished spaces a minimum of 1/4-inch beyond the box edge to provide a finished appearance. Finish edge of cover to match cover face.
12. Mount cast boxes or plaster trims for weatherproof outlets horizontally.

3.05 CONDUIT TYPE REQUIREMENTS

- A. Galvanized Rigid Steel Conduit (GRSC). Uses permitted:
 1. Direct-buried.
 2. Embedded or encased in concrete.
 3. Exiting concrete (extend GRSC 18-inches beyond penetration).
 4. Exposed in buildings from floor level to a height of 8-feet, except as noted below.
 5. Exposed to weather, corrosive, or hazardous conditions, including interior exposures.
- B. PVC Coated Rigid Steel Conduit. Uses permitted:
 1. Embedded or encased in concrete.
 2. Exposed to weather, corrosive, or hazardous conditions.
- C. Electrical Metallic Tubing (EMT). Uses permitted:
 1. In dry, protected locations.
 2. Exposed at a height more than 8-feet above floor level, or more than 18-inches above floor level in HVAC equipment rooms, utility tunnels, communication equipment rooms, electrical rooms, or unoccupied spaces, unless otherwise noted on the drawings.
- D. Flexible Metal Conduit.
 1. Use where flexibility is necessary, as at motors, transformers, recessed light fixtures, and the like. Flexible conduit terminations at motors, transformers, and the like, shall be limited to 18-inches. Use flexible conduit for other purposes only after obtaining Owner approval.
- E. Polyvinylchloride Conduit (PVC), Schedule 40. Uses permitted:
 1. Embedded or encased in concrete (use GRSC where conduits exit concrete work).
 2. Direct-buried 18-inches or more below grade.
- F. Polyvinylchloride Conduit (PVC), Schedule 80. Uses permitted:
 1. Direct-buried 18-inches or more below grade.
 2. Embedded or encased in concrete (use GRSC where conduits exit concrete work and extend GRSC 18-inches beyond penetration).
 3. Exposed to corrosive conditions inside building.
- G. Metal Raceway.
 1. Use in dry, protected locations for equipment requiring multi-connection wiring or where subject to physical damage.
- H. High-Density Polyethylene Conduit (HDPE). Uses permitted:
 1. Horizontal directional drilling installations.

3.06 RACEWAY AND CONDUIT SIZES

- A. Size raceways and conduits as indicated on the drawings. Where no size is indicated, size as follows:
 1. Larger conduits shall be sized to code. Size for the quantity of conductors installed, based upon NEC tables.
 2. Conduit installed underground or in concrete shall be 1-inch or larger.
 3. Conduits shall be 3/4-inch minimum size with larger sizes as indicated on the drawings. Conduits with tenant lease space buildouts may use conduits smaller than 3/4-inch.
 4. Communications conduit runs may be combined as follows:
 - a. Two outlets: 1 1/4-inch size.
 - b. Three outlets: 1 1/2-inch size.

RACEWAY & BOXES FOR ELECTRICAL SYSTEMS

3.07 FITTINGS

- A. Assemble metallic raceways and conduits in one continuous piece and secure to boxes, panels, and the like with appropriate fittings to maintain electrical continuity. All conduit joints shall be cut square and reamed smooth with all fittings drawn up tight.

3.08 PULL LINES

- A. Install nylon pull lines in all empty conduits where routing includes 25-feet or more in length or includes 180 degrees or more in bends.
- B. Where conduits requiring pull lines are stubbed out and capped, coil a minimum of 36-inches of pull line and tape at termination of conduit for easy future access. Label pull lines as to conduit starting or termination point or intended future use.

END OF SECTION

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 DESCRIPTION

- A. Clearly and properly identify the complete electrical system to indicate the loads served or the function of each item of equipment connected under this work.
- B. Provide conduit and cable identification as shown on the Drawings.

1.02 REFERENCES

- A. ANSI: American National Standards Institute
 - 1. ANSI Z535.4: Product Safety Signs and Labels
- B. NEC: National Electric Code
 - 1. NEC Article 110: Requirements for Electrical Installation
- C. OSHA: Occupational Safety and Health Administration

PART 2 PRODUCTS

2.01 LABELS

- A. Pre-Printed: Permanent material pre-printed with black on white, with adhesive backing. Brady, 3M, or equal.
- B. Laminated Plastic: 3-ply laminated plastic, color as indicated, with 1/2-inch high white letters for low voltage and 1-inch high white letters for high voltage. Lamicoid, or equal.
- C. Plastic Tape: Black or red with white letters, adhesive backing, field-printed with proper tool. Dymo-tape, or equal.
- D. Marker Tape: Clear adhesive-backed tape with black letters, for device plates. Kroy, or equal.
- E. Wire Markers: White with black numbers, adhesive-backed tape on dispenser roll. Brady, 3M, or equal.
- F. Marker Pen: Black permanent marker suitable for writing on metallic surfaces.
- G. Clearance Warning Tape: 2-inch wide self-adhesive vinyl type, black/yellow stripes. Seton, Brady, or equal.

PART 3 EXECUTION

3.01 LOW VOLTAGE SWITCHGEAR

- A. Label all low voltage switchboards and protective devices with laminated plastic labels indicating the function or the load served.
- B. Provide laminated plastic labels for all bussed spaces indicating the maximum ampere rating or size of future breaker or switch that may be installed in the space reserved.

3.02 BRANCH CIRCUIT PANELBOARDS

- A. Indicate panel number, source, and if applicable, transformer number from which the panel is fed with laminated plastic labels attached to face trim.
- B. Provide typewritten or power system software generated panel directories, with protective, clear transparent covers, accurately accounting for every breaker installed, including spares. Schedules shall use the actual loads and room designations assigned by name or number near completion of the work. Do not use the designations from the drawings.

3.03 MOTOR CONTROL CENTERS

- A. Label all motor control centers with laminated plastic labels.
- B. Label all starters and breakers with factory-provided labels or laminated plastic labels indicating the function or the load served and location.
- C. Provide pre-printed labels for all spaces.

IDENTIFICATION FOR ELECTRICAL SYSTEMS

3.04 TRANSFORMERS AND UPS

- A. Label all transformers and UPS with laminated plastic labels indicating equipment number, source, and load.

3.05 EQUIPMENT

- A. Label all disconnect switches, individual circuit breakers, security and communications panels, relays, contactors, time switches, and indicating equipment with laminated plastic labels indicating equipment number, source, and circuit number.
- B. Where the controlling device is remote mounted from the serving panel, include the serving panel designation and circuit number with additional plastic tape labels.

3.06 DEVICES

- A. All receptacle plates shall be marked in black permanent marker tape on the face of the plate, with the receptacles panel and branch circuit designation. The identification shall be made with clear self-adhesive tape with black 10-point letters. Apply the tape at the top of the device plate.
- B. Receptacles specified or noted on the drawings to be engraved, shall have the circuit information engraved in 3/16-inch letters on the front face of the plates. The alphabetic and numeric marking shall be made on the inside of the plate.
- C. Receptacles connected to a GFCI-protected circuit downstream from the protecting device shall be labeled "GFCI Protected."

3.07 CONDUIT AND CABLE

- A. Label all conduit runs and open cable wiring routed in cable tray or accessible ceiling spaces. Attach labels at the end of the conduit run and at least one per room. Place at entrances of all distribution panels, MCC, panelboards, etc.
- B. Label all conduit runs and open cable wiring routed in cable tray or accessible ceiling spaces. Space labels a maximum of 50 feet apart and at least one per room. Place at entrances of all "J" boxes, distribution panels, MCC, panelboards, etc.
- C. Use laminated plastic labels as shown in the [drawings] [attached labeling detail].
- D. Complete installation of labels prior to ceiling installation.

3.08 OUTLET, PULL, AND JUNCTION BOXES

- A. Paint fire alarm and security access system outlets, pull, and junction boxes in accordance with the directions of their specific Sections.
- B. Label all pull boxes and junction boxes for fire alarm, security, surveillance, and communications systems with plastic tape, red with white letters. Where boxes are recessed in finished areas, mount label on inside of cover.
- C. Label power junction boxes neatly by hand, indicating source and circuit number.

3.09 CONDUITS EXITING UNDERGROUND VAULTS

- A. At each conduit entry and exit through an interior vault wall, provide an engraved brass label and fill the letters with contrasting enamel paint. The label shall identify each conduit and where it terminates. For example, the top northern conduit would be labeled "#1 to CVLTx," where CVLTx is the end-point for that conduit run. The next lower conduit would be labeled sequentially as "#2 to CVLTx," etc.
- B. Provide corresponding labels at both ends of each conduit run including conduits that extend through interior walls of vaults, structures, or buildings.
- C. Place the labels on the wall adjacent to each conduit. Secure the labels into the concrete with stainless steel screws and wall anchors that allow the label to be replaced if necessary.

IDENTIFICATION FOR ELECTRICAL SYSTEMS

3.10 UNDERGROUND VAULT DESIGNATIONS

- A. Provide a label on each vault that indicates the assigned vault designation. Vault designations will be assigned by the Owner.
- B. Labels shall be constructed from engraved stainless steel or brass. Text height shall be a minimum 1 inch tall. Adjust the size of the label to include all the characters in the designation. Use stainless steel fasteners to secure the labels. Bead welding on top of the manhole cover is an acceptable alternative.
- C. Locate the label on the top of the vault, on the manhole cover or lid, or in another location coordinated with the Owner. Where the vault will be covered, place label on the manhole cover or other visible location.

3.11 SYSTEMS

- A. Complex control circuits may utilize any combination of colors with each conductor identified throughout, using wrap-around numbers or letters. Use the number or letters shown where the drawings or operation and maintenance data indicate wiring identification.
- B. Label the fire alarm and communication equipment zones, controls, indicators, etc., with pre-printed labels or indicators appropriate for the equipment installed, as supplied or recommended by the equipment manufacturer.
- C. Label each end of pull wires left in empty conduits with tags or tape indicating location of other end of wire.

3.12 CLEARANCE WARNING TAPE

- A. Affix to floor clearance warning tape to define area in front and around electrical switchgear, panels, and motor control centers. Type layout shall conform to the requirements of NEC 110 and OSHA.
- B. Remove debris and clean area prior to installing tape.

3.13 ARC FLASH WARNING LABELS

- A. Warning labels shall comply with ANSI Z535.4. Color in top part of sign shall be ANSI "safety orange." All lettering on label shall be black.
- B. Labels shall be self-adhesive. Outdoor labels shall be suitable for high-UV environment.
- C. Label dimension shall be 4 inches by 6 inches wide.

3.14 ARC FLASH WARNING LABELS

- A. A minimum of 4 weeks prior to anticipated substantial completion, submit the following information to the Owner for the arc flash analysis on newly installed equipment:
 - 1. Feeder sizes for each piece of equipment including feeder type, length, configuration, and raceway type in which feeder is installed.
 - 2. Overcurrent protection equipment brand name, model number, and any breaker settings and/or fuse sizes. Provide information for all overcurrent devices including Owner owned equipment feeding new feeders and newly installed equipment.
 - 3. Equipment AIC rating.
- B. The Contractor shall install labels furnished by the Owner.

END OF SECTION

PANELBOARDS

PART 1 GENERAL

1.01 DESCRIPTION

- A. This Section describes materials and installation for panelboards.

1.02 REFERENCES

- A. NEC: National Electrical Code

1.03 SUBMITTALS

- A. Coordination Study:
1. Submit a coordination study for the electrical overcurrent devices to assure proper equipment and personnel protection.
- B. Product Data: Submit product data for each type of panelboard, overcurrent protective device, accessory and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings and finishes.
- C. Closeout Submittals:
1. Operation and maintenance data.
 2. Warranty information.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Acceptable manufacturers for panelboard, and all associated products are:
1. General Electric Co.: Electrical Distribution & Control Division.
 2. Siemens Energy & Automation, Inc.
 3. Square D/Group Schneider.
 4. Eaton Cutler-Hammer.
 5. Pre-bid approved.

2.02 BRANCH PANELBOARDS

- A. Branch circuit panels shall be bolt-in circuit breaker type with copper bussing. Panels shall be fitted with flush lift latches and locks keyed alike. Deliver all panel keys at completion of the project.
- B. Circuit breakers shall be molded case, thermal magnetic or solid-state type as required to provide coordination. Breakers shall have short circuit capacity rating to withstand the maximum short circuit duty which can be expected at the breaker location in the electrical system. Breakers mounted in branch panelboards shall be of the bolt-in type. Minimum short circuit rating for any circuit breaker as shown on the Drawings.
- C. Branch circuit breakers shall be identified with individual circuit numbers adjacent to each breaker and with a typewritten card to identify the load controlled by that breaker.
- D. Where required, panels shall have main circuit breakers, sized as scheduled, mounted behind door at top of panel (back feeding of branch breaker is not acceptable).
- E. Wiring gutters shall be a minimum of 4-inches wide except where feeder conductors enter, where a minimum of 6-inches clearance shall be provided. Feeder conductors shall enter directly in line with lug terminals wherever practicable. Provide separate feeder lugs and studs for each feeder conductor.
- F. Panels shall have door-in-door construction. Flush panels shall have flush doors with concealed hinges and mounting clamps. Surface panels shall have metal face trims with no sharp edges or corners. Factory finished surface panel tubs shall match face trim.

PANELBOARDS

- G. Panels shall have a grounding bus with termination capacity for the grounding conductor sized for the branch circuit equipment grounding conductors as shown or noted. Isolated ground bus shall be insulated from the panel cabinet.
- H. Provide mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install the equipment as shown on the drawings, parallel and square with the building lines. Provide code clearances as required.
- B. Install a spare 3/4-inch conduit from flush panels for every three single-pole breakers or spaces provided. Terminate conduits above accessible ceiling or as directed.
- C. Neatly lace and secure the conductors of the feeder circuits individually at maximum 2-foot intervals. The cable lugs shall not support the weight of the cables.
- D. Equipment Tests:
 - 1. Perform tests on the ground fault protection system in accordance with the manufacturer's instructions. Record results and submit with final warranty.
 - 2. Adjust breaker settings per recommendation of coordination study and test all ground fault settings as required by NEC.

3.02 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."
- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 26 Section "Identification for Electrical Systems."

3.03 CLEANING

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to clean. Repair exposed surfaces to match original finish.

END OF SECTION

WIRING DEVICES

PART 1 GENERAL

1.01 DESCRIPTION

- A. This Section describes wiring devices, plates, and blank plates for outlet boxes.

1.02 SUBMITTALS

- A. Submit product data, shop drawings, and samples.

PART 2 PRODUCTS

2.01 GENERAL

- A. Wiring devices shall be specification grade, with special devices as noted on the drawings. Should the drawings indicate a device other than those listed herein without reference to catalog number, such device shall be of the same grade and manufacturer as specified below. Furnish a matching cap for all special purpose devices that do not have the common 120V NEMA 5-15R or 5-20R configuration.
- B. All lighting switches and duplex receptacles installed shall be by the same manufacturer and shall be identical in appearance, unless noted otherwise.

2.02 WALL SWITCHES

- A. Acceptable Manufacturers: Arrow-Hart, Bryant, Eagle, General Electric, Hubbell, Leviton, Pass & Seymour, Sylvania, or equal.
- B. Line Voltage Switches: 20-ampere, 277V, quiet type, grey exposed finish, back and side wired, Hubbell 1221 series.
- C. Lighted Handle Switches: 20-ampere, 120V or 277V, red handle with neon pilot light, Hubbell 1221 PL series.
- D. Momentary Contact Switches: 15A, SPDT, center off, grey exposed finish, Hubbell 1556-T.
- E. Key Switches: 20A, SPST, lock type, Hubbell 1201-L with 1209 key.

2.03 DIMMERS

- A. Acceptable Manufacturers: Lutron, Prescolite, or equal.
- B. General: Solid state silicone gated with RFI filter. Linear slide control with positive on/off switch for standard wall box mounting.
 - 1. Incandescent Dimmers: Single manual local control with lamp debuzzing coil, 600- to 2000-watt capacity, 120V, white finish. Sizes as indicated on the drawings. Lutron Nova N series.

2.04 RECEPTACLES

- A. Acceptable Manufacturers: Arrow-Hart, Bryant, Eagle, General Electric, Hubbell, Leviton, Pass & Seymour, Sylvania, or equal.
- B. General Application Duplex: 3-wire, 2-pole grounding, NEMA 5-20R, grey nylon exposed finish, back and side wired, Hubbell 5362 series.
- C. UPS System Duplex: 3-wire, 2-pole grounding, NEMA 5-20R, black nylon exposed finish, back and side wired, Hubbell 5362 series.
- D. Emergency System Duplex: NEMA 5-20R, lighted red nylon exposed finish, back and side wired, Hubbell 8300-R series.
- E. Isolated Grounding Duplex: NEMA 5-15R, orange nylon exposed finish, back and side wired, Hubbell IG-5262 series.
- F. Ground Fault Interrupting Duplex: Feed through, NEMA 5-20R, grey nylon exposed finish, Hubbell GF-5362 series.
- G. Special Purpose Receptacles: As noted on the drawings. Provide with NEMA configurations.

WIRING DEVICES

2.05 PLATES

- A. Acceptable Manufacturers: Arrow-Hart, Appleton, Bryant, Eagle, General Electric, Hubbell, Leviton, Pass & Seymour, Sylvania, or equal.
- B. Flush Finish Plates: .040-inch thick, type 302 stainless steel, brush finish. Provide engraving as indicated on the drawings.
- C. Surface Galvanized or Cadmium Plated Steel: 1/2-inch raised industrial type with openings appropriate for device installed.
- D. Receptacle Weatherproof: Gasketed cast aluminum, double lift, cover mounted horizontally with hinges up, 3-1/4-inch internal depth, lockable. UL listed for wet locations with cord plug inserted. Red Dot Code Keeper Extra-Duty While-in-Use Cover series, or equal.
- E. Switch Weatherproof: Gasketed cast aluminum switch operator. Appleton FSK series.
- F. Tamperproof: Flush cast aluminum locking cover plate, cylinder type lock, master keyed, Pass & Seymour 4600 series.

2.06 OCCUPANCY SENSORS

- A. Wall-Box Mounted: Passive infrared type, 180-degree coverage, automatic-on, 3-wire type (no minimum load), daylight override, adjustable time-out, and override off switch. Sensorswitch #WSD (line voltage), Sensorswitch #WSD-CU (low voltage), Wattstopper #WS, or pre-bid approved equal.
- B. Ceiling Mounted: Dual technology type, 360-degree coverage, automatic-on, adjustable time-out, low- or line-voltage as shown on the drawings, automatic gain control, surface mounted, with power pack as required. Sensorswitch #PDT-CM/CU-20, Wattstopper series WP1R, or pre-bid approved equal.
- C. Relay Output: Sensors shall provide a single pole double throw isolated relay contact for use by the HVAC control system.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Devices and finish plates shall be installed plumb with building lines. Wall-mounted receptacles shall be installed vertically at the centerline height shown on the drawings.
- B. Install finish plates and devices after final painting is complete. Scratched or splattered finish plates and devices will not be accepted.
- C. Special plugs, such as cord caps furnished with the receptacles, shall be furnished in their cartons.

3.02 COORDINATION

- A. The drawings indicate the approximate location of all devices. Refer to architectural elevations, sections, and details for exact locations.
- B. Work with the equipment installer to coordinate the locations and methods of connection to devices mounted in or near cabinets, counters, benches and similar equipment.

3.03 OCCUPANCY SENSORS

- A. Locate sensors to provide maximum coverage of the room, to operate as someone enters the room, and to avoid false operation due to persons outside the room passing an open door.
- B. Provide additional sensing heads as necessary to achieve complete coverage of each room.
- C. Set sensitivity as required to provide small movement coverage throughout the room without extending coverage beyond the room.
- D. Test system performance with the sensor timing set to the minimum time delay available. Once complete coverage of a given room has been demonstrated, set the delay to 15-minutes.

WIRING DEVICES

3.04 FIELD TESTING

- A. Receptacles shall be tested for line-to-neutral, line-to-ground, and neutral-to-ground faults.
Correct any defective wiring.

END OF SECTION

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.01 DESCRIPTION

- A. Provide switches as indicated on the drawings, in the specifications and where required by the National Electrical Code, even though not indicated. Provide fused or non-fused switches as shown on the drawings and as required by equipment manufacturer or circuit requirements.
- B. This Section describes the following individually mounted, enclosed switches and circuit breakers:
 - 1. Fusible switches.
 - 2. Non-fusible switches.
 - 3. Molded-case circuit breakers.
 - 4. Molded-case switches.
 - 5. Low-voltage and current-limiting fuses
 - 6. Enclosures.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 26 0529, Hangers and Supports for Electrical Systems
- B. Section 26 0553, Identification for Electrical Systems

1.03 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. HD: Heavy duty.
- C. RMS: Root mean square.
- D. SPDT: Single pole, double throw.

1.04 REFERENCES

- A. CFR: Code of Federal Regulations
 - 1. 29 CFR 1910.7: Definition and Requirements for a Nationally Recognized Testing Laboratory
- B. NEC: National Electric Code
- C. NECA: National Electrical Contractors Association
 - 1. NECA 1: Standard Practice of Good Workmanship in Electrical Construction
- D. NEMA: National Electrical Manufacturers Association
 - 1. NEMA FU 1: Low-Voltage Cartridge Fuses
 - 2. NEMA PB 1.1: General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600V or Less
 - 3. NEMA PB 2.1: General Instructions for Proper Handling, Installation, Operation and Maintenance of Deadfront Distribution Switchboards Rated 600V or Less
- E. NETA: International Electrical Testing Association
 - 1. NETA ATS: Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems
- F. NFPA: National Fire Protection Association
 - 1. NFPA 70: National Electric Code
- G. OR-OSHA: Oregon Occupational Safety and Health Administration
- H. UL: Underwriters Laboratories
 - 1. UL 198C: Standard for Safety for High-Interrupting-Capacity Fuses, Current-Limiting Types
 - 2. UL 198D: Class K Fuses
 - 3. UL 198E: Class R Fuses
 - 4. UL 198H: Class T Fuses

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

1.05 SUBMITTALS

- A. Product Data: Submit for each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current rating.
 - 4. UL listing for series rating of installed devices.
 - 5. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- B. Field quality-control test reports including the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- C. Operation and Maintenance Data: Include data for enclosed switches and circuit breakers in operation and maintenance manuals. In addition to items specified in Division 01, include the following:
 - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 - 2. Time-current curves, including selectable ranges for each type of circuit breaker.

1.06 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OR-OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.
- D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

PART 2 PRODUCTS

2.01 FUSIBLE AND NON-FUSIBLE SWITCHES

- A. Acceptable Manufacturers:
 - 1. General Electric Co., Electrical Distribution & Control Division.
 - 2. Siemens Energy & Automation, Inc.
 - 3. Square D/Group Schneider.
 - 4. Eaton Cutler-Hammer.
 - 5. Pre-bid approved equal.
- B. Fusible Switch: NEMA KS 1, Type HD, quick-make, quick-break, dual-rated with electrical characteristics as required by the system voltage and the load served. Include clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

- C. Non-fusible Switch: NEMA KS 1, Type HD, quick-make, quick-break, dual-rated with electrical characteristics as required by the system voltage and the load served. Include lockable handle with capability to accept two padlocks and interlocked with cover in closed position.

2.02 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

- A. Acceptable Manufacturers:
1. General Electric Co., Electrical Distribution & Control Division.
 2. Siemens Energy & Automation, Inc.
 3. Square D/Group Schneider.
 4. Eaton Cutler-Hammer.
 5. Pre-bid approved equal.
- B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 3. Electronic Trip-Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.
 4. GFCI Circuit Breakers: Single- and two-pole configurations with 30-mA trip sensitivity.
- C. Molded-Case Circuit-Breaker Features and Accessories:
1. Standard frame sizes, trip ratings, and number of poles.
 2. Lugs: Mechanical style with compression lug kits suitable for number, size, trip ratings, and conductor material.
- D. Molded-Case Switches: Molded-case circuit breaker with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- E. Molded-Case Switch Accessories:
1. Lugs: Mechanical style with compression lug kits suitable for number, size, trip ratings, and material of conductors.
 2. Application Listing: Type HACR for heating, air-conditioning, and refrigerating equipment.
 3. Auxiliary Switch: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

2.03 LOW-VOLTAGE AND CURRENT-LIMITING FUSES

- A. Conform to NEMA FU 1. Time delay and non-time delay options shall be as shown on the drawings.
- B. Provide equipment with a complete set of properly rated fuses when the equipment manufacturer utilizes fuses in the manufacture of the equipment, or if current-limiting fuses are required to be installed to limit the ampere-interrupting capacity of circuit breakers or equipment to less than the maximum available fault current at the location of the equipment to be installed.
- C. Fuses shall have a voltage rating of not less than the phase-to-phase circuit voltage and shall have the time-current characteristics required for effective power system coordination.

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

- D. Cartridge Fuses: Cartridge fuses, current-limiting type, Class J K RK1 RK5 shall have tested interrupting capacity not less than 100,000 amperes. Fuse holders shall be the type that will reject Class H fuses.
 - 1. Class J fuses shall conform to UL 198C.
 - 2. Class K fuses shall conform to UL 198D.
 - 3. Class R fuses shall conform to UL 198E.
 - 4. Class T fuses shall conform to UL 198H.
- E. Transformer Circuit Fuses: Transformer circuit fuses shall be Class RK1 or RK5, current-limiting, time-delay with 200,000 amperes interrupting capacity.

2.04 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
 - 1. Outdoor Locations: NEMA 250, Type 3R.
 - 2. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 CONCRETE BASES

- A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.
- B. Concrete base is specified in Section 26 0529 and concrete materials and installation requirements are specified in Division 03.

3.03 INSTALLATION

- A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
- B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.
- C. Comply with mounting and anchoring requirements specified in Section 26 0529.
- D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.04 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section 26 0553.
- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Section 26 0533.

3.05 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Prepare for acceptance testing as follows:
 - 1. Inspect mechanical and electrical connections.
 - 2. Verify switch and relay type and labeling verification.
 - 3. Verify rating of installed fuses.
 - 4. Inspect proper installation of type, size, quantity, and arrangement of mounting or anchorage devices complying with manufacturer's certification.

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

- C. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:
- D. Perform the following field tests and inspections and prepare test reports:
 - 1. Test mounting and anchorage devices according to requirements in Section 26 05 29.
 - 2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
 - 3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 4. Infrared Scanning:
 - a. Initial Infrared Scanning: After substantial completion, but not more than 60 days after final acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Open or remove doors or panels so connections are accessible to portable scanner.
 - b. Follow-Up Infrared Scanning: Perform an additional follow-up infrared scan of each unit 11 months after date of substantial completion.
 - c. Instruments, Equipment and Reports:
 - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 2) Prepare a certified report that identifies enclosed switches and circuit breakers included and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.06 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

3.07 CLEANING

- A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.
- B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION

LIGHTING

PART 1 GENERAL

1.01 DESCRIPTION

- A. This Section describes specific lighting requirements.

1.02 REFERENCES

- A. ANSI: American National Standards Institute
1. ANSI C62.41: Surge Voltages in Low-Voltage AC Power Circuits
- B. FCC: Federal Communications Commission
1. FCC Part 18: Industrial, Scientific, and Medical Equipment
- C. UL: Underwriters Laboratories

1.03 SUBMITTALS

- A. "Pre-Bid Approved Equal" Submittal Requirements:
1. To be considered, submit the following specific information and product samples:
 - a. A sample of each type of proposed luminaire, identical in construction and ratings to that specified.
 - b. Complete photometric data, including coefficient of utilization curve, isofootcandle curves, and distribution data in tabular form for each type of luminaire proposed.
 - c. Ballast data, including manufacturer's name, model number, wiring diagram, lamp type and watts for which the unit is capable of operating, power factor and current crest factor.
 2. Equality shall be determined by the following luminaire characteristics:
 - a. Performance:
 - 1) Distribution.
 - 2) Utilization.
 - 3) Average brightness/maximum brightness.
 - 4) Spacing to mounting height ratio.
 - 5) Visual comfort probability.
 - b. Construction:
 - 1) Engineering.
 - 2) Workmanship.
 - 3) Rigidity.
 - 4) Permanence of materials and finishes.
 - c. Installation Ease:
 - 1) Captive parts and captive hardware.
 - 2) Provision for leveling.
 - 3) Through-wiring ease.
 - d. Appearance:
 - 1) Light tightness.
 - 2) Neat, trim styling.
- B. Submit the following contract submittal requirements:
1. Shop drawings.
 2. Product data.
 3. Photometric reports that include:
 - a. Candlepower distribution curves.
 - b. Coefficient of utilization table.
 - c. Zonal lumen summary.
 - d. Certification of lamp ballast compatibility.
 - e. Operation and maintenance data.
 - f. Operational sample upon request.

LIGHTING

1.04 WARRANTY

- A. Electronic ballasts shall be warranted against defects in materials and workmanship for a minimum of three years.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Recessed luminaires shall have trims that fit neatly and tightly to the surfaces on which they are installed, without leaks or gaps. Where necessary, install heat resistant non-rubber gaskets to prevent light leaks or moisture from entering between luminaires' trim and the surface to which they are mounted.
- B. Luminaires installed under canopies, roofs, or open areas and similar damp or wet locations shall be UL listed and labeled as suitable for damp or wet locations.
- C. Aligners shall be ball type with nominally 45-degree movement either side of center. Provide white stem aligner canopies where installed in finished areas.
- D. Luminaires shall be new and complete with mounting accessories, junction boxes, wiring whips, trims, and lamps.

2.02 FIXTURE LIST

- A. See Fixture Schedule on the Drawings.

2.03 POLES AND STANDARDS

- A. Steel Poles:
 - 1. Round or octagonal area tapered, minimum 11-gauge steel with a minimum 8-inch diameter base.
 - 2. Supplied with a minimum 3-inch x 5-inch reinforced handhole with a removable cover.
 - 3. Welded seams or joints which will be visible after complete installation shall be ground so that they will not be noticeable after galvanizing.
 - 4. Luminaire mounting height shall be as shown on the drawings. Verify pole height for each location to maintain the proper mounting height.
 - 5. Designed to withstand 100-mph continuous wind with 1.25-gust factor without failure or permanent deformation. Base pole wind load design on pole installed with the specified luminaires, mounting brackets, and obstruction light.
 - 6. Each pole assembly shall include four anchor bolts (each with leveling nut, anchor nut, and washers), galvanized after threading. Bolt size and length shall be as required to withstand design loads. Provide anchor bolts for pole base attachment to a structural steel plate. Coordinate anchor bolt requirements with structural provisions.
 - 7. Poles and mounting brackets shall be hot-dip galvanized after fabrication.
 - 8. Provide reinforced pole mounting brackets for floodlight luminaires 180 degrees apart. Mounting brackets shall accommodate specified luminaire mounting requirements and accommodate wiring internally.
 - 9. Provide means to support all pole riser wiring without depending on the luminaire attachments.
 - 10. Submittals for approval of poles shall include calculations to demonstrate that complete structure will meet the continuous gust wind loading criteria and shall include complete shop drawings of the poles with specified reinforcements and handholes in detail.

2.04 SITE LIGHTING FIXTURES

- A. Apron floodlighting luminaires shall be cutoff type floodlights, with NEMA 7X5 reflector and dual level (38-percent and 100-percent light output) 480-volt ballast.

LIGHTING

2.05 LUMINAIRES TO BE RE-USED

- A. Existing luminaires in areas to be demolished have been identified for re-use.
 - 1. Luminaires to be re-used shall be disconnected from power and removed intact with all mounting accessories. All existing electrical components including ballasts, lamps, sockets, and remove wiring. Install new ballasts, sockets, lamps, and wiring for a complete and operable system.
 - 2. All housings, ballast compartments, tracks, components, and mounting accessories to be re-used shall be cleaned with a heavy-duty cleaner, rinsed, and dried prior to installation of new electrical components. The housings and components shall be clean and uniform in color when completed.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Luminaires shall be assembled and installed according to the manufacturers' instructions, the drawings, and these specifications.
- B. After installation, the units shall be clean.
- C. Determine ceiling types in each area and provide suitable accessories and mounting frames where required for recessed luminaires. Luminaire catalog numbers do not necessarily denote specific mounting accessories for type of ceiling in which a luminaire may be installed.
- D. Level luminaires align in straight lines and locate as shown on the drawings. The final decision as to adequacy of support and alignment will be given by the Owner. The fixtures shall be supported by separate means from the building structure and not from the ceiling system, ductwork, piping, or other systems.
- E. Aim luminaires to provide the lighting pattern for which the luminaire is designed and as directed.
- F. Manufacturer's labels or monograms shall not be visible after luminaire is installed but shall be included for future reference.
- G. When lamping tungsten halogen luminaires, wear silk gloves to insert lamps.
- H. Tungsten halogen luminaires shall not be energized during construction to prevent dust build up on lamp, socket, and lamp chamber. Lamping shall occur as last stage of construction.

3.02 POLES AND STANDARDS INSTALLATION

- A. The pole foundation is shown on the drawings. At some locations, excavation may reveal subsurface conditions or utilities which preclude use of the standard design. Each such location will be dealt with as it is found at the direction of the Owner.
- B. After setting foundation or wood pole in place, backfill with non-shrink grout or concrete as applicable so that the pole will be virtually installed in undisturbed soil.
- C. Verify, before assembly of poles and luminaires, that exterior finishes are not chipped or otherwise marred.
- D. Assemble pole sections per manufacturer's recommendations.
- E. Poles and luminaires shall be completely assembled and wired before erection.
- F. Steel Pole Erection:
 - 1. Set leveling nuts on anchor bolts with enough freedom to permit leveling of pole.
 - 2. Raise pole and set on anchor bolts without slinging. Set anchor nuts only finger-tight before leveling.
 - 3. Level base plates by adjusting nut pairs until pole is vertical, then tighten anchor nuts securely while ensuring that pole remains vertical. Install anchor bolt/baseplate cover, if used.
 - 4. Make wiring splices in handhole, dress wiring, and install handhole cover.

LIGHTING

- G. Grout baseplate to enclose levelling nuts, with a 45-degree bevel outside fillet between baseplate and foundation. Provide a drainway, using an easily removable blackout plug, to allow condensed moisture to drain from pole interior.

3.03 FIRE RATING COVER

- A. Provide protective coverings for all luminaires recessed in fire-rated ceilings. Covering materials shall provide a UL-listed, one-hour fire rating assembly.
- B. Coordinate locations from the drawings.
- C. Luminaires shall be listed for use in fire-rated cover.

3.04 TESTING

- A. Test lighting circuits and meet the requirements specified in Section 26 05 00, Common Work Results for Electrical.
- B. Lighting systems shall be operationally tested. Utilize a light meter to confirm that light levels agree favorably with the design, which was based on the luminaire specified.
- C. Should results prove unacceptable and cause is attributed to the Contractor, the costs of corrections and subsequent additional testing shall be the Contractor's responsibility.

END OF SECTION

COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Category 6 twisted pair cable.
 - 2. Category 6a twisted pair cable.
 - 3. Twisted pair cable hardware, including plugs and jacks.
 - 4. Multiuser telecommunications outlet assembly.
 - 5. Cable management system.
 - 6. Cabling identification products.
 - 7. Grounding provisions for twisted pair cable.
 - 8. Source quality control requirements for twisted pair cable.

1.03 DEFINITIONS

- A. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- B. EMI: Electromagnetic interference.
- C. FTP: Shielded twisted pair.
- D. F/FTP: Overall foil screened cable with foil screened twisted pair.
- E. F/UTP: Overall foil screened cable with unscreened twisted pair.
- F. IDC: Insulation displacement connector.
- G. LAN: Local area network.
- H. Jack: Also commonly called an "outlet," it is the fixed, female connector.
- I. Plug: Also commonly called a "connector," it is the removable, male telecommunications connector.
- J. RCDD: Registered Communications Distribution Designer.
- K. Screen: A metallic layer, either a foil or braid, placed around a pair or group of conductors.
- L. Shield: A metallic layer, either a foil or braid, placed around a pair or group of conductors.
- M. S/FTP: Overall braid screened cable with foil screened twisted pair.
- N. S/UTP: Overall braid screened cable with unscreened twisted pairs.
- O. UTP: Unscreened (unshielded) twisted pair.

1.04 COPPER HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C, and the equipment outlet, otherwise known as "Cabling Subsystem 1," in the telecommunications cabling system structure. Cabling system consists of horizontal cables, intermediate and main cross-connections, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.
 - 1. TIA-568-C.1 requires that a minimum of two equipment outlets be installed for each work area.
 - 2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connection and the telecommunications equipment outlet.
 - 3. Bridged taps and splices shall not be installed in the horizontal cabling.
- B. A work area is approximately 100-sq. ft. (9.3-sq. m.) and includes the components that extend from the equipment outlets to the station equipment.

COMMUNICATIONS COPPER HORIZONTAL CABLING

- C. The maximum allowable horizontal cable length is 295-feet (90-m). This maximum allowable length does not include an allowance for the length of 16-feet (4.9-m) to the workstation equipment or in the horizontal cross-connect.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
1. Test each pair of twisted pair cable for open and short circuits.

1.07 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.08 COORDINATION

- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.
B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.
C. Grounding: Comply with TIA-607-B.

2.02 GENERAL CABLE CHARACTERISTICS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:
1. Communications, Plenum Rated: Type CM, Type CMG, Type CMP, Type CMR, or Type CMX in metallic conduit installed according to NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."
2. Communications, Non-plenum: Type CMP or Type CMR in metallic conduit installed according to NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."
B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.
C. RoHS compliant.

2.03 CATEGORY 6 TWISTED PAIR CABLE

- A. Description: Four-pair, balanced-twisted pair cable, with internal spline, certified to meet transmission characteristics of Category 6 cable at frequencies up to 250-MHz.
B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. 3M.
2. Belden CDT Networking Division/NORDX.
3. Berk-Tek Leviton; a Nexans/Leviton alliance.
4. General Cable; General Cable Corporation.
5. Genesis Cable Products; Honeywell International, Inc.
6. Superior Essex Inc.

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- C. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568-C.2 for Category 6 cables.
- D. Conductors: 100-ohm, 23-AWG solid copper.
- E. Shielding/Screening: Unshielded twisted pairs (UTP).
- F. Cable Rating: Plenum.
- G. Jacket: Blue thermoplastic.

2.04 CATEGORY 6A TWISTED PAIR CABLE

- A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6a cable at frequencies up to 500MHz.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. 3M.
 - 2. Belden CDT Networking Division/NORDX.
 - 3. Berk-Tek Leviton; a Nexans/Leviton alliance.
 - 4. General Cable; General Cable Corporation.
 - 5. Genesis Cable Products; Honeywell International, Inc.
 - 6. Superior Essex Inc.
- C. Standard: Comply with TIA-568-C.2 for Category 6a cables.
- D. Conductors: 100-ohm, 23-AWG solid copper.
- E. Shielding/Screening: Unshielded twisted pairs (UTP).
- F. Cable Rating: Plenum.
- G. Jacket: Blue thermoplastic.

2.05 TWISTED PAIR CABLE HARDWARE

- A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. 3M.
 - 2. AMP NETCONNECT; a TE Connectivity Ltd. company.
 - 3. Belden CDT Networking Division/NORDX.
 - 4. Berk-Tek Leviton; a Nexans/Leviton alliance.
 - 5. General Cable; General Cable Corporation.
 - 6. Genesis Cable Products; Honeywell International, Inc.
 - 7. Leviton Manufacturing Co., Inc.
 - 8. Panduit Corp.
 - 9. Superior Essex Inc.
- C. General Requirements for Twisted Pair Cable Hardware:
 - 1. Comply with the performance requirements of Category 6 Category 6a.
 - 2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
 - 3. Cables shall be terminated with connecting hardware of same category or higher.
- D. Source Limitations: Obtain twisted pair cable hardware from single source from single manufacturer.
- E. Connecting Blocks:
 - 1. 110-style IDC for Category 6.
 - 2. 110-style IDC for Category 6a.
 - 3. Number of Terminals per Field: One for each conductor in assigned cables.

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- F. Plugs and Plug Assemblies:
 - 1. Male; eight-position; color-coded modular telecommunications connector designed for termination of a single 4-pair, 100-ohm, unshielded or shielded twisted pair cable.
 - 2. Standard: Comply with TIA-568-C.2.
- G. Jacks and Jack Assemblies:
 - 1. Female; eight-position; modular; fixed telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
 - 2. Designed to snap-in to a patch panel or faceplate.
 - 3. Standard: Comply with TIA-568-C.2.
- H. Faceplate / Wall Plate:
 - 1. Number of ports as indicated on Drawings; vertical single-gang faceplates designed to mount to single-gang wall boxes.
 - 2. Comply with requirements in Section 26 27 26 "Wiring Devices."
 - 3. For use with snap-in jacks accommodating any combination of twisted pair, optical fiber, and coaxial work area cords.
 - a. Flush mounting jacks, positioning the cord at a 45-degree angle.
- I. Legend:
 - 1. Machine printed, in the field, using adhesive-tape label.
 - 2. Snap-in, clear-label covers and machine-printed paper inserts.

2.06 IDENTIFICATION PRODUCTS

- A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.07 GROUNDING

- A. Comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.
- B. Comply with TIA-607-B.

2.08 SOURCE QUALITY CONTROL

- A. Factory test cables on reels according to TIA-568-C.1.
- B. Factory test twisted pair cables according to TIA-568-C.2.

PART 3 EXECUTION

3.01 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays, except within consoles, cabinets, desks, and counters. Conceal raceway and cables, except in unfinished spaces.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.

3.02 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

- A. Comply with NECA 1 and NECA/BICSI 568.
- B. General Requirements for Cabling:
 - 1. Comply with TIA-568-C.0, TIA-568-C.1, and TIA-568-C.2.
 - 2. Comply with BICSI's "Information Transport Systems Installation Methods Manual (ITSIMM), Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.

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3. Install 110-style IDC termination hardware unless otherwise indicated.
 4. Do not untwist twisted pair cables more than 1/2-inch (12-mm) from the point of termination to maintain cable geometry.
 5. T568B pinout termination wiring schemes shall be used.
 6. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 7. MUTOA shall not be used as a cross-connect point.
 8. Consolidation points may be used only for making a direct connection to equipment outlets:
 - a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
 - b. Locate consolidation points for twisted-pair cables at least 49-feet (15-m) from communications equipment room.
 9. Cables may not be spliced. Secure and support cables at intervals not exceeding 30-inches (760-mm) and not more than 6-inches (150-mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 10. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
 11. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI Information Transport Systems Installation Methods Manual , Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.
 12. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation, and replace it with new cable.
 13. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 14. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
 15. Pulling Cable: Comply with BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.
- C. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 2. Suspend twisted pair cabling, not in a wireway or pathway, a minimum of 8-inches (200-mm) above ceilings by cable supports not more than 60-inches (1524-mm) apart.
 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- D. Installation of Cable Routed Exposed under Raised Floors:
1. Install plenum-rated cable only.
 2. Install cabling after the flooring system has been installed in raised floor areas.
 3. Coil cable 6-feet (1800-mm) long not less than 12-inches (300-mm) in diameter below each feed point.
- E. Group connecting hardware for cables into separate logical fields.
- F. Separation from EMI Sources:
1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.
 2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2-kVA: A minimum of 5-inches (127-mm).

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- b. Electrical Equipment Rating between 2- and 5-kVA: A minimum of 12-inches (300-mm).
 - c. Electrical Equipment Rating More Than 5-kVA: A minimum of 24-inches (600-mm).
- 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2-kVA: A minimum of 2-1/2-inches (64-mm).
 - b. Electrical Equipment Rating between 2 and 5-kVA: A minimum of 6-inches (150-mm).
 - c. Electrical Equipment Rating More Than 5-kVA: A minimum of 12-inches (300-mm).
- 4. Separation between communications cables in grounded metallic raceways, power lines, and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2-kVA: No requirement.
 - b. Electrical Equipment Rating between 2- and 5-kVA: A minimum of 3-inches (76-mm).
 - c. Electrical Equipment Rating More Than 5-kVA: A minimum of 6-inches (150-mm).
- 5. Separation between Communications Cables and Electrical Motors and Transformers, 5-kVA or HP and Larger: A minimum of 48-inches (1200-mm).
- 6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5-inches (127-mm).

3.03 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-D, Annex A, "Firestopping."
- C. Comply with "Firestopping Systems" Article in BICSI's "Telecommunications Distribution Methods Manual."

3.04 GROUNDING

- A. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."
- B. Comply with TIA-607-B and NECA/BICSI-607.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 4-AWG grounding electrode conductor.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6-AWG equipment grounding conductor.

3.05 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
 - 1. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.
- B. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.
- C. Cable and Wire Identification:
 - 1. Label each cable within 4-inches (100-mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.

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2. Each wire connected to building-mounted devices is not required to be numbered at the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15-feet (4.5-m).
 4. Label each terminal strip, and screw terminal in each cabinet, rack, or panel.
 - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
 - b. Label each unit and field within distribution racks and frames.
 5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and -connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- D. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-B requirements for the following:
1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.06 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments and inspect cabling connections for compliance with TIA-568-C.1.
 2. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- C. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- D. End-to-end cabling will be considered defective if it does not pass tests and inspections.

END OF SECTION

DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Fire-alarm control unit.
 - 2. Manual fire-alarm boxes.
 - 3. System smoke detectors.
 - 4. Heat detectors.
 - 5. Notification appliances.
 - 6. Device guards.
 - 7. Firefighters' smoke-control station.
 - 8. Magnetic door holders.
 - 9. Remote annunciator.
 - 10. Addressable interface device.

1.03 DEFINITIONS

- A. EMT: Electrical Metallic Tubing.
- B. FACP: Fire Alarm Control Panel.
- C. PC: Personal computer.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product, including furnished options and accessories.
 - 1. Include construction details, material descriptions, dimensions, profiles, and finishes.
 - 2. Include rated capacities, operating characteristics, and electrical characteristics.
- B. Shop Drawings: For fire-alarm system.
 - 1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
 - 2. Include plans, elevations, sections, details, and attachments to other work.
 - 3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
 - 4. Detail assembly and support requirements.
 - 5. Include voltage drop calculations for notification-appliance circuits.
 - 6. Include battery-size calculations.
 - 7. Include input/output matrix.
 - 8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
 - 9. Include performance parameters and installation details for each detector.
 - 10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 - 11. Provide program report showing that air-sampling detector pipe layout balances pneumatically within the airflow range of the air-sampling detector.
 - 12. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.
 - a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
 - b. Show field wiring required for HVAC unit shutdown on alarm.
 - c. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' control system.

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- d. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' smoke-evacuation system.
- e. Locate detectors according to manufacturer's written recommendations.
- 13. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
- 14. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.
- C. General Submittal Requirements:
 - 1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
 - 2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. Licensed or certified by authorities having jurisdiction.
- D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
 - 2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
 - 3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:
 - a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
 - c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
 - d. Riser diagram.
 - e. Device addresses.

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- f. Air-sampling system sample port locations and modeling program report showing layout meets performance criteria.
 - g. Record copy of site-specific software.
 - h. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
 - 1) Equipment tested.
 - 2) Frequency of testing of installed components.
 - 3) Frequency of inspection of installed components.
 - 4) Requirements and recommendations related to results of maintenance.
 - 5) Manufacturer's user training manuals.
 - i. Manufacturer's required maintenance related to system warranty requirements.
 - j. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.
- B. Software and Firmware Operational Documentation:
- 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.

1.07 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- 1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
 - 2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
 - 3. Smoke Detectors, Fire Detectors: Quantity equal to 10-percent of amount of each type installed, but no fewer than one unit of each type.
 - 4. Detector Bases: Quantity equal to 2-percent of amount of each type installed, but no fewer than one-unit of each type.
 - 5. Keys and Tools: One extra set for access to locked or tamper proof components.
 - 6. Audible and Visual Notification Appliances: One of each type installed.
 - 7. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.

1.08 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).

1.09 PROJECT CONDITIONS

- A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.
- B. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
- 1. Notify Construction Manager no fewer than seven days in advance of proposed interruption of fire-alarm service.
 - 2. Do not proceed with interruption of fire-alarm service without Construction Manager's written permission.
- C. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

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1.10 SEQUENCING AND SCHEDULING

- A. Existing Fire-Alarm Equipment: Maintain existing fire alarm panel, in existing building, and coordinate installation of, new, like type devices as shown on the drawings. Coordinate installation of new panel and associated equipment in Building F per drawings. New panel shall have integrated communication and control with the existing panel in the existing building.
- B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. UL-certified addressable system, with multiplexed signal transmission and horn-and-strobe notification for evacuation.
- B. Noncoded, UL-certified addressable system, with multiplexed signal transmission and horn/strobe evacuation.
- C. Automatic sensitivity control of certain smoke detectors.
- D. All components provided shall be listed for use with the selected system.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.02 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices:
 - 1. Manual stations.
 - 2. Smoke detectors.
 - 3. Automatic sprinkler system water flow.
- B. Fire-alarm signal shall initiate the following actions:
 - 1. Continuously operate alarm notification appliances.
 - 2. Identify alarm and specific initiating device at fire-alarm control unit and remote annunciators.
 - 3. Transmit an alarm signal to the remote alarm receiving station.
 - 4. Unlock electric door locks in designated egress paths.
 - 5. Release fire and smoke doors held open by magnetic door holders.
 - 6. Activate voice/alarm communication system.
 - 7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
 - 8. Activate smoke-control system (smoke management) at firefighters' smoke-control system panel.
 - 9. Activate stairwell and elevator-shaft pressurization systems.
 - 10. Close smoke dampers in air ducts of designated air-conditioning duct systems.
 - 11. Activate emergency lighting control.
 - 12. Activate emergency shutoffs for gas and fuel supplies.
 - 13. Record events in the system memory.
 - 14. Record events by the system printer.
 - 15. Indicate device in alarm on the graphic annunciator.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
 - 1. Valve supervisory switch.
 - 2. High- or low-air-pressure switch of a dry-pipe or pre-action sprinkler system.

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3. Alert and Action signals of air-sampling detector system.
 4. Elevator shunt-trip supervision.
 5. Fire pump running.
 6. Fire-pump loss of power.
 7. Fire-pump power phase reversal.
 8. Independent fire-detection and -suppression systems.
 9. User disabling of zones or individual devices.
 10. Loss of communication with any panel on the network.
- D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
 2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
 4. Loss of primary power at fire-alarm control unit.
 5. Ground or a single break in internal circuits of fire-alarm control unit.
 6. Abnormal ac voltage at fire-alarm control unit.
 7. Break in standby battery circuitry.
 8. Failure of battery charging.
 9. Abnormal position of any switch at fire-alarm control unit or annunciator.
 10. Voice signal amplifier failure.
 11. Hose cabinet door open.
- E. System Supervisory Signal Actions:
1. Initiate notification appliances.
 2. Identify specific device initiating the event at fire-alarm control unit and remote annunciators.
 3. Record the event on system printer.
 4. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.
 5. Transmit system status to building management system.
 6. Display system status on graphic annunciator.

2.03 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.04 FIRE-ALARM CONTROL UNIT

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
- B. General Requirements for Fire-Alarm Control Unit:
1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.
 - a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
 - b. Include a real-time clock for time annotation of events on the event recorder and printer.
 - c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
 - d. The FACP shall be listed for connection to a central-station signaling system service.

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- e. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.
 - 2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
 - 3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.
- C. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
 - 1. Annunciator and Display: Liquid-crystal type, three line(s) of 80 characters, minimum.
 - 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
- D. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:
 - 1. Pathway Class Designations: NFPA 72, Class B.
 - 2. Install no more than 100 addressable devices on each signaling-line circuit.
- E. Stairwell Pressurization: Provide an output signal using an addressable relay to start the stairwell pressurization system. Signal shall remain on until alarm conditions are cleared and fire-alarm system is reset. Signal shall not stop in response to alarm acknowledge or signal silence commands.
 - 1. Pressurization starts when any alarm is received at fire-alarm control unit.
 - 2. Alarm signals from smoke detectors at pressurization air supplies have a higher priority than other alarm signals that start the system.
- F. Notification-Appliance Circuit:
 - 1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
 - 2. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
 - 3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.
- G. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
- H. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals shall be powered by 24-V dc source.
 - 1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
- I. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
 - 1. Batteries: Sealed lead calcium.
- J. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

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2.05 PRE-ACTION SYSTEM

- A. Initiate Pre-signal Alarm: This function shall cause an audible and visual alarm and indication to be provided at the FACP. Activation of an initiation device connected as part of a pre-action system shall be annunciated at the FACP only, without activation of the general evacuation alarm.

2.06 MANUAL FIRE-ALARM BOXES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
- B. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
 - 1. Single-action mechanism, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 - 2. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 - 3. Station Reset: Key- or wrench-operated switch.
 - 4. Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.

2.07 SYSTEM SMOKE DETECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
- B. General Requirements for System Smoke Detectors:
 - 1. Comply with UL 268; operating at 24-V dc, nominal.
 - 2. Detectors shall be two-wire type.
 - 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
 - 4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 - 5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 - 6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
 - 7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
 - a. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F per minute.
 - b. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F.
 - c. Multiple levels of detection sensitivity for each sensor.
 - 8. Sensitivity levels based on time of day.
- C. Photoelectric Smoke Detectors:
 - 1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 - 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.

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- c. Present average value.
- d. Present sensitivity selected.
- e. Sensor range (normal, dirty, etc.).

2.08 NOTIFICATION APPLIANCES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
- B. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
 - 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.
- C. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch-high letters on the lens.
 - 1. Rated Light Output:
 - a. 15/30/75/110 cd, selectable in the field.
 - 2. Mounting: Wall mounted unless otherwise indicated.
 - 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
 - 4. Flashing shall be in a temporal pattern, synchronized with other units.
 - 5. Strobe Leads: Factory connected to screw terminals.
 - 6. Mounting Faceplate: Factory finished, red.
- D. Exit Marking Audible Notification Appliance:
 - 1. Exit marking audible notification appliances shall meet the audibility requirements in NFPA 72.
 - 2. Provide exit marking audible notification appliances at the entrance to all building exits.
 - 3. Provide exit marking audible notification appliances at the entrance to areas of refuge with audible signals distinct from those used for building exit marking.

2.09 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
 - 1. Mounting: Surface cabinet, NEMA 250, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.10 ADDRESSABLE INTERFACE DEVICE

- A. General:
 - 1. Include address-setting means on the module.
 - 2. Store an internal identifying code for control panel use to identify the module type.
 - 3. Listed for controlling HVAC fan motor controllers.
- B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- C. Integral Relay: Capable of providing a direct signal to initiate smoke removal system.
 - 1. Allow the control panel to switch the relay contacts on command.
 - 2. Have a minimum of two normally open and two normally closed contacts available for field wiring.
- D. Control Module:
 - 1. Operate notification devices.

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2. Operate solenoids for use in sprinkler service.

2.11 DEVICE GUARDS

- A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
 1. Factory fabricated and furnished by device manufacturer.
 2. Finish: Paint of color to match the protected device.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
 1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.
- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
 1. Devices placed in service before all other trades have completed cleanup shall be replaced.
 2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.
- B. All separate buildings on this site are to be connected and controller from the main fire alarm control panel located in fire pump room 003. In the event of a fire alarm at a separated building, the main fire alarm control panel will initiate an alarm trouble signal but not initiate a building alarm at the main building.
- C. Install new Fire Alarm Panel:
 1. Connect new equipment to new control panel in in Building F.
 2. Connect new equipment to existing Fire Alarm Panel in existing building.
 3. Expand, modify, and supplement existing equipment as necessary to extend existing control functions between the new panel and the existing panel. New components shall be capable of merging with existing configuration without degrading the performance of either system.
- D. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.
- E. Manual Fire-Alarm Boxes:
 1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
 2. Mount manual fire-alarm box on a background of a contrasting color.
 3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.
- F. Smoke- or Heat-Detector Spacing:
 1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.

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2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A or Annex B in NFPA 72.
5. HVAC: Locate detectors not closer than 60 inches from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.
- G. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.
- H. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.
- I. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.
- J. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.
- K. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling. Install all devices at the same height unless otherwise indicated.
- L. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.03 PATHWAYS

- A. Pathways above recessed ceilings and in non-accessible locations may be routed exposed.
 1. Exposed pathways located less than 96 inches above the floor shall be installed in EMT.
- B. Pathways shall be installed in EMT.

3.04 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 08 71 00 "Door Hardware." Connect hardware and devices to fire-alarm system.
 1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
 1. Alarm-initiating connection to smoke-control system (smoke management) at firefighters' smoke-control system panel.
 2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
 3. Smoke dampers in air ducts of designated HVAC duct systems.
 4. Magnetically held-open doors.
 5. Electronically locked doors and access gates.
 6. Alarm-initiating connection to elevator recall system and components.
 7. Alarm-initiating connection to activate emergency lighting control.
 8. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
 9. Supervisory connections at valve supervisory switches.
 10. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
 11. Supervisory connections at elevator shunt-trip breaker.
 12. Data communication circuits for connection to building management system.
 13. Data communication circuits for connection to mass notification system.

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14. Supervisory connections at fire-extinguisher locations.
15. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
16. Supervisory connections at fire-pump engine control panel.

3.05 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

3.06 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
- B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.07 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
 - b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
- C. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- D. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.
- F. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- G. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.08 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall

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include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

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3.09 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
- C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
 - 1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.10 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aggregate base course.
- B. Double course bituminous concrete paving.
- C. Surface sealer.

1.02 REFERENCE STANDARDS

- A. AI MS-19 - Basic Asphalt Emulsion Manual.
- B. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Asphalt Cement: ASTM D946.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.

3.02 BASE COURSE

- A. If base course is required, place and compact base course.

3.03 PREPARATION - PRIMER

- A. Apply primer in accordance with manufacturer's instructions.
- B. Apply primer on aggregate base or subbase at uniform rate of 1/3 gal/sq yd.
- C. Use clean sand to blot excess primer.

3.04 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

- A. Place asphalt binder course within 24 hours of applying primer or tack coat.
- B. Place wearing course within two hours of placing and compacting binder course.
- C. Install gutter drainage grilles and frames in correct position and elevation.
- D. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- E. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.05 SEAL COAT

- A. Apply seal coat to surface course in accordance with AI MS-19.

3.06 TOLERANCES

- A. Variation from True Elevation: Within 1/2 inch.

3.07 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for quality control.

3.08 SCHEDULE

- A. Pavement at Parking Areas: Two courses; binder course of 2-1/2 inch compacted thickness and wearing course of 1 inch compacted thickness, fog seal coat.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Parking lot markings, including parking bays, crosswalks, access aisles, arrows, accessible symbols, and curb markings.

1.02 RELATED REQUIREMENTS

- A. Section 32 12 16 - Asphalt Paving.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Deliver paint in containers of at least 5 gallons accompanied by batch certificate.
- B. Deliver glass beads in containers suitable for handling and strong enough to prevent loss during shipment accompanied by batch certificate.
- C. Store products in manufacturer's unopened packaging until ready for installation.
- D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.04 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.01 MATERIALS

- A. Line and Zone Marking Paint: MPI (APL) No. 97 Latex Traffic Marking Paint; color(s) as indicated.
 - 1. Parking Spaces and Zones: Yellow.
 - 2. Accessible Symbols: Blue.
 - 3. Fire zones and no parking areas: Red.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

- A. Allow new pavement surfaces to cure for a period of not less than 14 days before application of marking materials.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Obliteration of existing markings using paint is acceptable in lieu of removal; apply paint in as many coats as necessary to completely obliterate the existing markings.
- D. Clean surfaces thoroughly prior to installation.
 - 1. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods.
 - 2. Completely remove rubber deposits, existing paint markings, and other coatings adhering to the pavement, by scraping, wire brushing, sandblasting, mechanical abrasion, or approved chemicals.
 - 3. Sandblasting: Use equipment of size and capacity necessary, providing not less than 150 cfm of air at pressure not less than 90 psi at each nozzle used.

- E. Where oil or grease are present, scrub affected areas with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application; after cleaning, seal oil-soaked areas with cut shellac to prevent bleeding through the new paint.

3.03 INSTALLATION

- A. Begin pavement marking as soon as practicable after surface has been cleaned and dried.
- B. Do not apply paint if temperature of surface to be painted or the atmosphere is less than 50 degrees F or more than 95 degrees F.
- C. Apply in accordance with manufacturer's instructions using an experienced technician that is thoroughly familiar with equipment, materials, and marking layouts.
- D. Comply with FHWA MUTCD manual (<http://mutcd.fhwa.dot.gov>) or standards as required by local jurisdiction in the state where the Project is located for details not shown.
- E. Apply uniformly painted markings of color(s), lengths, and widths as indicated on drawings true, sharp edges and ends.
 - 1. Apply paint in one coat only.
 - 2. Wet Film Thickness: 0.015 inch, minimum.
 - 3. Width Tolerance: Plus or minus 1/8 inch.
- F. Symbols: Use a suitable template that will provide a pavement marking with true, sharp edges and ends, of the design and size indicated.

3.04 DRYING, PROTECTION, AND REPLACEMENT

- A. Protect newly painted markings so that paint is not picked up by tires, smeared, or tracked.
- B. Provide barricades, warning signs, and flags as necessary to prevent traffic crossing newly painted markings.
- C. Allow paint to dry at least the minimum time specified by the applicable paint standard and not less than that recommended by the manufacturer.
- D. Remove and replace markings that are applied at less than minimum material rates; deviate from true alignment; exceed length and width tolerances; or show light spots, smears, or other deficiencies or irregularities.
- E. Remove markings in manner to avoid damage to the surface to which the marking was applied, using carefully controlled sand blasting, approved grinding equipment, or other approved method.
- F. Replace removed markings at no additional cost to Owner.

END OF SECTION